Research Methods for Management

MBA First Year
Paper No. 7

School of Distance Education
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CONTENTS

RESEARCH METHODS FOR MANAGEMENT

Number of Credit Hours : 3

Subject Description: This course presents the basic concept of research design, hypotheses, sampling techniques, testing the significance and report writing.

Goals: To enable the students to learn the importance of the research, various methods of analysis of data and its applications in the business management.

Objectives: On successful completion of the course the students should have:

1. understood the basic of the research methods..
2. learnt the various techniques of sampling.
3. learnt the various methods of analysis of data and its applicability in the decision making.
4. learnt to write a good research report.

UNIT I

Research - meaning - scope and significance - Types of research - Research Process - Characteristics of good research - Scientific method - Problems in research - Identifying research problem – concepts, constructs and theoretical framework.

UNIT II

Hypothesis:- meaning - sources - Types - formulation Research design - Types - case study - features of good design - measurement - meaning - need Errors in measurement - Tests of sound measurement Techniques of measurement - scaling Techniques - meaning - Types of scales - scale construction techniques.

UNIT III

Sampling design - meaning - concepts - steps in sampling - criteria for good sample design - Types of sample designs - Probability and non-probability samples. Data collection:- Types of data - sources - Tools for data collection methods of data collection - constructing questionnaire - Pilot study - case study - Data processing:- coding - editing - and tabulation of data - Data analysis.

UNIT IV

Test of Significance:- Assumptions about parametric and non-parametric tests. Parametric Test - T test, F Test and Z test - Non Parametric Test - U Test, Kruskal Wallis, sign test. Multivariate analysis-factor, cluster, MDS, Discriminant ananlysis. (NO Problems). SPSS and its applications.

UNIT V

Interpretation - meaning - Techniques of interpretation - Report writing:- Significance - Report writing:- Steps in report writing - Layout of report - Types of reports - Oral presentation - executive summary - mechanics of writing research report - Precautions for writing report - Norms for using Tables, charts and diagrams - Appendix:- norms for using Index and Bibliography.

UNIT-I

LESSON

1

FUNDAMENTALS OF RESEARCH

CONTENTS

1.0 AIMS AND OBJECTIVES

In this Lesson we will discuss the basic fundamentals of research. After going through this lesson you will be able to:

(i) describe meaning and objectives of research.

(ii) differentiate between different types of research.

(iii) describe scope and significance of research.

1.1 INTRODUCTION

Research in common man's language refers to "search for Knowledge".

Research is an art of scientific investigation. It is also a systematic design, collection, analysis and reporting the findings & solutions for the marketing problem of a company. Research is required because of the following reasons:

- To identify and find solutions to the problems

- To help making decisions
- To develop new concepts
- To find alternate strategies

To identify and find solutions to the problem:

To understand the problem in depth, Example: "Why is that demand for a product is falling"? "Why is there a business fluctuation once in three years"? By identifying the problem as above, it is easy to collect the relevant data to solve the problem.

To help making decisions:

Example: Should we maintain the advertising budget same as last year? Research will answer this question.

To find alternative strategies:

Should we follow pull strategy or push strategy to promote the product.

To develop new concepts:

Example: CRM, Horizontal Marketing, MLM etc.

1.2 SCOPE AND SIGNIFICANCE OF RESEARCH

i. ***Decision-making tool:*** Whenever a decision is to be made, marketing research becomes necessary in the corporate world. The degree of dependence on research is based on the cost of decisions. If the cost of decision is high, the dependence on research is high, and vice versa.

ii. ***Facilitates large- scale production:*** The MR helps large scale enterprises in the areas of production to determine:

   (a) What to produce?

   (b) How much to produce?

   (c) When to produce?

iii. ***To determine the pattern of consumption:*** The consumption patterns vary from place to place and time to time. The MR helps in identifying the consumption pattern and also the availability of consumer credit in that particular place.

   MR helps the marketer to identify:

   - Consumption pattern
   - Brand loyalty
   - Consumer behaviour
   - Market trends, etc.

iv. ***Complex market:*** In a complex and dynamic environment, the role of MR is very vital. MR acts as a bridge between the consumer and the purchaser. This is because MR enables the management to know the need of the customer, the about demand for the product and helps the producer to anticipate the changes in the market.

v. ***Problem-solving:*** The MR focuses on both short range and long range decisions and helps in making decisions with respect to the 4p's of marketing, namely, product, price, place and promotion.

vi. ***Distribution:*** The MR helps the manufacturer to decide about the channel, media, logistics planning so that its customers and distributors are benefited. Based on the study of MR, suitable distributors, retailers, wholesalers and agents are selected by the company for distributing their products.

vii. ***Sales promotion:*** The MR helps in effective sales promotion. It enlightens the manufacturer with regard to the method of sales promotion to be undertaken, such as advertising, personal selling, publicity etc. It also helps in understanding the

attitude of the customers and helps how to design the advertisement in line with prevailing attitudes.

1.3 THE TYPES OF RESEARCH

There are different types of research.

1.3.1 Exploratory Research

This type of research is carried out at the very beginning when the problem is not clear or is vague. In exploratory research, all possible reasons which are very obvious are eliminated, thereby directing the research to proceed further with limited options.

Sales decline in a company may be due to:

(1) Inefficient service

(2) Improper price

(3) Inefficient sales force

(4) Ineffective promotion

(5) Improper quality

The research executives must examine such questions to identify the most useful avenues for further research. Preliminary investigation of this type is called exploratory research. Expert surveys, focus groups, case studies and observation methods are used to conduct the exploratory survey.

1.3.2 Descriptive Research

The main purpose of descriptive research is to describe the state of view as it exists at present. Simply stated, it is a fact finding investigation. In descriptive research, definite conclusions can be arrived at, but it does not establish a cause and effect relationship. This type of research tries to describe the characteristics of the respondent in relation to a particular product.

- Descriptive research deals with demographic characteristics of the consumer. For *example*, trends in the consumption of soft drink with respect to socio-economic characteristics such as age, family, income, education level etc. Another example can be the degree of viewing TV channels, its variation with age, income level, profession of respondent as well as time of viewing. Hence, the degree of use of TV to different types of respondents will be of importance to the researcher. There are three types of players who will decide the usage of TV : (a) Television manufacturers, (b) Broadcasting agency of the programme, (c) Viewers. Therefore, research pertaining to any one of the following can be conducted:
- The manufacturer can come out with facilities which will make the television more user-friendly. Some of the facilities are– (a) Remote control, (b) Child lock, (c) Different models for different income groups, (d) Internet compatibility etc., (e) Wall mounting etc.
- Similarly, broadcasting agencies can come out with programmes, which can suit different age groups and income.
- Ultimately, the viewers who use the TV must be aware of the programmes appearing in different channels and can plan their viewing schedule accordingly.
- Descriptive research deals with specific predictions, for example, sales of a company's product during the next three years, i.e., forecasting.
- Descriptive research is also used to estimate the proportion of population who behave in a certain way. Example: "Why do middle income groups go to Food World to buy their products?"

A study can be commissioned by a manufacturing company to find out various facilities that can be provided in television sets based on the above discussion.

Similarly, studies can be conducted by broadcasting stations to find out the degree of utility of TV programmes. Example: The following hypothesis may be formulated about the programmes*:*

- The programmes in various channels are useful by way of entertainment to the viewers.
- Viewers feel that TV is a boon for their children in improving their knowledge—especially, fiction and cartoon programmes.

1.3.3 Applied Research

Applied research aims at finding a solution for an immediate problem faced by any business organization. This research deals with real life situations. *Example:* "Why have sales decreased during the last quarter"? Market research is an example of applied research. Applied research has a practical problem-solving emphasis. It brings out many new facts.

Examples:

1. Use of fibre glass body for cars instead of metal.
2. To develop a new market for the product.

1.3.4 Pure/Fundamental Research or Basic Research

Gathering knowledge for knowledge's sake is known as basic research. It is not directly involved with practical problems. It does not have any commercial potential. There is no intention to apply this research in practice. Tata Institute of Fundamental Research conducts such studies. *Example:* Theory of Relativity (by Einstein).

1.3.5 Conceptual Research

This is generally used by philosophers. It is related to some abstract idea or theory. In this type of research, the researcher should collect the data to prove or disapprove his hypothesis. The various ideologies or 'isms' are examples of conceptual research.

1.3.6 Causal Research

Causal research is conducted to determine the cause and effect relationship between the two variables.

Example: Effect of advertisement on sales.

1.3.7 Historical Research

The name itself indicates the meaning of the research. Historical study is a study of past records and data in order to understand the future trends and development of the organisation or market. There is no direct observation. The research has to depend on the conclusions or inferences drawn in the past.

For example, investors in the share market study the past records or prices of shares which he/she intends to buy. Studying the share prices of a particular company enables the investor to take decision whether to invest in the shares of a company.

Crime branch police/CBI officers study the past records or the history of the criminals and terrorists in order to arrive at some conclusions.

The main objective of this study is to derive explanation and generalization from the past trends in order to understand the present and anticipate the future.

There are however, certain shortcomings of Historical Research:

1. Reliability and adequacy information is subjective and open to question

2. Accuracy of measurement of events is doubtful.
3. Verification of records are difficult.

1.3.8 Ex-post Facto Research

In this type of research, an examination of relationship that exists between independent and dependent variable is studied. We may call this empirical research. In this method, the researcher has no control over an independent variable. Ex-post facto literally means "from what is done afterwards". In this research, a variable "A" is observed. Thereafter, the researcher tries to find a causal variable "B" which caused "A". It is quite possible that "B" might not have been caused "A". In this type of analysis, there is no scope for the researcher to manipulate the variable. The researcher can only report "what has happened" and "what is happening".

1.3.9 Action Research

This type of research is undertaken by direct action. Action research is conducted to solve a problem. *Example:* Test marketing a product is an example of action research. Initially, the geographical location is identified. A target sample is selected from among the population. Samples are distributed to selected samples and feedback is obtained from the respondent. This method is most common for industrial products, where a trial is a must before regular usage of the product.

1.3.10 Evaluation Research

This is an example of applied research. This research is conducted to find out how well a planned programme is implemented. Therefore, evaluation research deals with evaluating the performance or assessment of a project. *Example:* "Rural Employment Programme Evaluation" or "Success of Midday Meal Programme".

1.3.11 Library Research

This is done to gather secondary data. This includes notes from the past data or review of the reports already conducted. This is a convenient method whereby both manpower and time are saved.

Check Your Progress

1. What are the reasons for sales decline in a company?
2. What are different types of research?

1.4 LET US SUM UP

Research originates in a decision process. In research process, management problem is converted into a research problem. Which is the major objective of the study. Research question is further subdivided, covering various facets of the problem that need to be solved. The role and scope of research has greatly increased in the field of business and economy as a whole. The study of research methods provides you with knowledge and skills you need to solve the problems and meet the challenges of today is modern pace of development

1.5 LESSON-END ACTIVITY

An Indian company dealing in pesticides hires a qualified business management graduate to expand its marketing activities. Most of the current employees of the company are qualified chemists with science background. During their first review meeting the

management graduate says that the "company should be involved in market research to get a better perspective of the problem on hand". On hearing this, one of the science graduate laughs and says "There is no such thing as marketing or business research, research is combined to science alone."

What would be your response?

1.6 KEYWORDS

Unambiguous

Blueprint

Research methodology

Action research

Ex-postfact research

Evaluation research

Applied research

Explorator research

Descriptive research

1.7 QUESTIONS FOR DISCUSSION

1. What is the importance of research?
2. What are the types of research?
3. What are the good criteria of research?
4. What is a research problem?

1.8 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007

Abrams, M.A, *Social Surveys and Social Action,* London: Heinemann, 1951.

Arthur, Maurice, *Philosophy of Scientific Investigation,* Baltimore: John Hopkins University Press, 1943.

Bernal, J.D., *The Social Function of Science,* London: George Routledge and Sons, 1939.

Chase, Stuart, *The Proper Study of Mankind:* An inquiry into the Science of Human Relations, New York, Harper and Row Publishers, 1958.

LESSON

2

RESEARCH PROCESS OF DESIGN

CONTENTS

2.0 AIMS AND OBJECTIVES

In Lesson 2 we will discuss the steps involved in research process and design. After studying this lesson you will be able to:

(i) understand steps involved in research process.
(ii) describe research methodology.
(iii) articulate problem formulation.
(iv) categorize research design.

2.1 INTRODUCTION

Research process involves gathering data, use statistical techniques, interpretations, and drawing conclusions about the research data. Research design is in fact the conceptual

structure within which the research is conducted. All the steps and questions related to research process and design have been studied in this lesson.

2.2 RESEARCH PROCESS

2.2.1 What is Research Problem?

A research problem refers to some difficulty which analyzing on is facing and wants to obtain the solution for the same.

While doing research, defining the problem is very important because "Problem clearly stated is half solved". This shows how important it is to "Define the problem correctly". While defining the problem, it should be noted that it should be "Unambiguous". If the problem defining is ambiguous, then the researcher will not know "what data is to be collected", "What technique is to be used" etc.

Example: Ambiguous definition: "Find out how much, sales has declined recently". Let us suppose that, the research problem is defined in broad and general way as follows:

"Why is the productivity in Korea is very much higher than in India"?

In this type of question, a number of ambiguities are there, such as:

- What sort of productivity is to be specified; Is it men, machine, materials? Etc.
- To Which type of industry, the productivity is related to?
- What period of time, the productivity is being talked about?

Example: Unambiguous definition: On the contrary, a problem will be as follows:-

"What are the factors responsible for increased labour productivity in Korean textile manufacturing industries during the decade 1996 to 2006 relative to Indian textile industries?

2.2.2 What is Research Methodology?

Research methodology is a method to solve the research problem systematically. It involves gathering data, use of statistical techniques, interpretations, and drawing conclusions about the research data. It is a blue print, which is followed, to complete the study. It is similar to builders blue print to build a house.

2.3 RESEARCH DESIGN / PLAN

Research design is one of the important steps in marketing research. It helps in establishing the way the researcher to go about to achieve, the objective of the study.

The preparation of a research design involves a careful consideration of the following questions and making appropriate decisions on them.

1. What the study is about?
2. Why is the study made?
3. What is its scope?
4. What are the objectives of study?
5. What are the hypothesis / Proportions to be tested?
6. What are the major concepts to be defined operationally?
7. What type of literature to be reviewed?
8. What is the area of the study?
9. What is reference period of the study?
10. What methodology is to be used?
11. What kinds of data are needed?
12. What are the sources of data?
13. What is the sampling boundary?
14. What are the sampling units?

15. What is the sample size?
16. What sampling techniques are to be used?
17. What data collection methods are to be used?
18. How the data are to be processed?
19. What are the statistical techniques are to be used for analysis?
20. To which target group, the finding are meant for?
21. What is the type of report to be prepared?
22. What is the duration of time required, for each stage of the research work?
23. What is the cost involved?
24. Who reads the report?

2.4 STEPS INVOLVED IN PREPARING MARKET RESEARCH PLAN OR DESIGNING A RESEARCH

There are nine steps in the research process, that can be followed while designing a research project, they are as follows:

- Problem formulation
- Evaluate the cost of research
- Preparing a list of needed information
- Research design decision and Data collection
- Select the sample types
- Determine the sample size
- Organize the fieldwork
- Analyze the data and report preparation

2.4.1 Problem Formulation

Problem formulation is the key to research process. For a researcher, problem formulation means converting the management problem to a research problem. In order to attain clarity, the M.R manager and researcher must articulate clearly so that perfect understanding of each others is achieved.

Example: Management problem and research problem

M.P – Want to increase the sale of product A.

R.P – What is the current standing of the product A?

While problem is being formulated, the following should be taken into account.

(1) Determine the objective of the study.

(2) Consider various environment factors.

(3) Nature of the problem.

(4) State the alternative

(1) ***Determine the objective:*** Objective may be general or specific. General – Would like to know, how effective was the advertising campaign.

The above looks like a statement with objective. In reality, it is far from it. There are two ways of finding out the objectives precisely. (1) The researcher should

clarify with the M.R manager "What effective means". Does effective mean, awareness or does it refer to sales increase or does it mean, it has improved the knowledge of the audience, or the perception of audience about the product.

In each of the above circumstances, the questions to be asked from audience varies (2) Another way to find objectives is to find out from the M.R Manager, "What action will be taken, given the specified outcome of the study. For example: If research finding is that, the previous advertisement by the company was indeed ineffective, what course of action the company intends to take (a) Increase the budget for the next Ad (b) Use different appeal (3) Change the media (4) Go to a new agency.

If objectives are proper, research questions will be precise. However we should remember that objectives, do undergo a change.

(2) ***Consider environmental factors:*** Environmental factors influence the outcome of the research and the decision. Therefore, the researcher must help the client to identify the environmental factors that are relevant.

Example: Assume that the company wants to introduce a new product like Iced tea or frozen green peas or ready to eat chapathis.

The following are the environmental factors to be considered.

(a) Purchasing habit of consumers.

(b) Presently, who are the other competitors in the market with same or similar product.

(c) What is the perception of the people about the other products of the company, with respect to price, image of the company.

(d) Size of the market and target audience.

All the above factors could influence the decision. Therefore researcher must work very closely with his client.

(3) ***Nature of the problem:*** By understanding the nature of the problem, the researcher can collect relevant data and help suggesting a suitable solution. Every problem is related to either one or more variable. Before starting the data collection, a preliminary investigation of the problem is necessary, for better understanding of the problem. Initial investigation could be, by using focus group of consumers or sales representatives.

If focus group is carried out with consumers, some of the following question will help the researcher to understand the problem better.

(a) Did the customer ever included this company's product in his mental map?

(b) If the customer is not buying the companies product, the reasons for the same.

(c) Why did the customer go to the competitor?

(d) Is the researcher contacting the right target audience?

(4) ***State the alternatives:*** It is better for the researcher to generate as many alternatives as possible during problem formulation hypothesis. Example: Whether to introduce a Sachet form of packaging with a view to increase sales. The hypothesis will state that, acceptance of the sachet by the customer will increase the sales by 20%. Thereafter, the test marketing will be conducted before deciding whether to introduce sachet or not. Therefore for every alternative, a hypothesis is to be developed.

2.4.2 Evaluate the Cost of Research

There are several methods to establish the value of research. Some of them are (1) Bayesian approach (2) Simple saving method (3) Return on investment (4) Cost benefit approach etc.

Example 1: Company 'X' wants to launch a product. The company's intuitive feeling is that, the product failure possibilities is 35%. However, if research is conducted and appropriate data is gathered, the chances of failure can be reduced to 30%. Company also has calculated, that the loss would be Rs. 3,00,000 if product fails. The company has received a quote from MR agency. The cost of research is Rs. 75,000. The question is " Should the company spend this money to conduct research?"

Calculation:

Loss without research = 3,00,000 × 0.35

= Rs. 1,05,000

Loss with research = 3,00,000 × 0.30

= Rs. 90,000

Value of research information

= 1,05,000 – 90,000

= Rs. 15,000

Since the value of information namely Rs. 15000 is lower than the cost of research Rs. 75,000, conducting research is not recommended.

Example 2: Company 'A' would like to introduce a new product in the market. The research agencies has given an estimation of 5 lakhs and a time period of five months. According the past experience of the company, the probability of earning 10 lakhs is 0.4 & 5 lakhs is 0.3 and loosing 7 lakhs is 0.3. Should the company under take the research?

Calculation:

$0.4 \times 10 + 0.3 \times 5 – 0.3 \times 7 = 4 + 1.5 – 2.1 = 3.4$ lakhs

Since we find that the expected value of information i.e. 3.4 lakhs is less than the cost of M.R at 5 lakhs, there is no need carry out the research.

2.4.3 Preparing a List of Needed Information

Assume that company 'X' wants to introduce a new product (Tea powder). Before introducing it, the product has to be test marketed. The company needs to know the extent of competition, price and quality acceptance from the market. In this context, following are the list of information required.

(a) ***Total demand and company sales:*** *Example:* What is the overall industry demand? What is the share of the competitor? The above information will help the management to estimate overall share and its own shares, in the market.

(b) ***Distribution coverage:*** *Example:*

(1) Availability of products at different outlets.

(2) Effect of shelf display on sales.

(c) ***Market awareness, attitude and usage:*** *Example:* "What percentage of target population are aware of firm's product"? "Do customers know about the product"? "What is the customers' attitude towards the product"? "What percentage of customers repurchased the product"?

(d) ***Marketing expenditure:*** *Example:* "What has been the marketing expenditure"? "How much was spent on promotion"?

(e) ***Competitors marketing expenditure:*** *Example:* "How much competitor spent, to market a similar product"?

2.4.4 Research Design Decision and Data Collection

(a) **Should the research be exploratory or conclusive?**

Exploratory research: *Example:* "Causes for decline in sales of a specific company's product in a specific territory under a specific salesman". The researcher may explore all possibilities why sales in falling?

- Faulty product planning
- Higher price
- Less discount
- Less availability
- Inefficient advertising/salesmanship
- Poor quality of salesmanship
- less awareness

Not all factors are responsible for decline in sales.

Conclusive research: Narrow down the option. Only one or two factors are responsible for decline in sales. Therefore zero down, and use judgment and past experience.

(b) ***Who should be interviewed for collecting data?:*** If the study is undertaken to determine whether, children influence the brand, for ready – to eat cereal (corn flakes) purchased by their parents. The researcher must decide, if only adults are to be studied or children are also to be included. The researcher must decide if data is to be collected by observation method or by interviewing. If interviewed, "Is it a personal interview or telephonic interview or questionnaire?"

(c) ***Should a few cases be studied or choose a large sample?:*** The researcher may feel that, there are some cases available which are identical and similar in nature. He may decide to use these cases for formulating the initial hypothesis. If suitable cases are not available, then the researcher may decide to choose a large sample.

(d) ***How to incorporate experiment in research?:*** If it is an experiment, "Where and when measurement should take place", should be decided. Example: In a test of advertising copy, the respondents can first be interviewed to measure their present awareness, and their attitudes towards certain brands. Then, they can be shown a pilot version of the proposed advertisement copy, following this, their attitude also is to be measured once again, to see if the proposed copy had any effect on them.

If it is a questionnaire, (a) What is the contents of the questionnaire? (b) What type of questions to be asked? Example: Pointed questions, general questions etc. (c) In what sequence should it be asked? (d) Should there be a fixed set of alternatives or should it be open ended. (e) Should the purpose be made clear to the respondents or should it be disguised? Are to be determined well in advance.

2.4.5 Select the Sample Types

The first task is to carefully select "What groups of people or stores are to be sampled". Example: Collecting the data from a fast food chain. Here, it is necessary to define what is meant by fast food chain. Also precise geographical location should be mentioned.

Next step is to decide whether to choose probability sampling or non probability sampling. Probability sampling is one, in which each element has a known chance of being selected. A non-probability sampling can be convenience or judgment sampling.

2.4.6 Determine the Sample Size

Smaller the sample size, larger the error, vice versa.

Sample size depends up on (a) Accuracy required (b) Time available (c) Cost involved.

While selecting the sample, the sample unit has to be clearly specified. Example: Survey

on the attitudes towards the use of shampoo with reference to a specific brand, where husbands, wives or combination of all of them are to be surveyed or a specific segment is to be surveyed. Sample size depends on the size of the sample frame/universe.

2.4.7 Organize the Fieldwork

This includes selection, training and evaluating the field sales force to collect the data (a) How to analyzing the field work? (b) What type of questionnaire – structured / unstructured to use? (c) How to approach the respondents? (d) Week, day and time to meet the specific respondents etc., are to be decided.

2.4.8 Analyze of the Data and Report Preparation

This involves (a) Editing (b) Tabulating (c) Codifying etc.

Editing: The data collected should be scanned, to make sure that it is complete and all the instructions are followed. This process is called editing. Once these forms have been edited, they must be coded.

Coding means, assigning numbers to each of the answers, so that they can be analyzed.

The final step is called as data tabulation. It is the orderly arrangement of the data in a tabular form. Also at the time of analyzing the data, the statistical tests to be used must be finalized such as T-Test, Z-test, Chi-square Test, ANOVA etc.

Check Your Progress

For the below mentioned scenario lay down your recommendation of the most suitable type of research (Explanatory) Descriptive, Experimentation, Longitudinal and cross-sectional). Explain the reasons for your choice

"A co-operative bank has 4,000 customers who have taken personal loan or vehicle loan of late, the bank feels that there has been an increase in the number of defaulters. The bank would like to know whether people who are regular (no default) and defaulters differ in terms of characteristics such as age, income, occupation, sex marital status."

2.5 WHAT ARE THE CRITERIA OR CHARACTERISTICS OF A GOOD RESEARCH?

2.5.1 A Good Research should be Systematic

This means that research should be structured. A good research will satisfy the steps to be taken in an orderly sequence according to a set of defined rules i.e., researcher uses scientific methods and therefore is systematic.

2.5.2 A Good Research should be Logical

There should be logical reasoning in any research. This logical process used could be induction or deduction. Induction is a process of reasoning from the part to the whole. To induce means to draw conclusion from one or more facts or pieces of evidence.

An example of Induction: An advertising company gathers information about market requirements from retailers/users from a small test market. Based upon the findings, say 'price', generalization is made regarding "What is the acceptable market price" or "Is the customer price sensitive"?

Deduction is a process of reasoning some premise and then reaching the conclusion which follows from that premise. In deduction, the conclusion drawn must necessarily follow the reason stated.

Example: "All products manufactured by Reebok Company are good. This leather wallet is a product of Reebok, so it must be good".

2.5.3 A Good Research should be Empirical

Empirical means the factual investigation is possible. Its validity can be checked through reliable sources and evidences. Research should be such that it can be validated, i.e., it should be possible to describe, interpret and explain the phenomenon.

2.5.4 A Good Research is Replicable

It means the research conducted can be repeated by any number of times. A researcher can verify the results by repeating the study and thereby delivering a sound decision-making framework. For example, if two research organisations undertake the same study, the results should be similar and not different. If the results are similar, then the research is will be replicable.

2.6 LET US SUM UP

In this lesson we have discussed the problem identification in research, steps invalued in research process and design, conceptual structure within which the research is conducted and criteria or characteristics of a good research.

The first and foremost step in the research process consists of problem identification. The research problem could be in any of the following three area:

(i) Exploratory;

(ii) Descriptive; or

(iii) Causal

Formulation of the problem means defining the problem precisely. The next step of the research process call for determining the information needed, developing a plan for gathering it efficiently. Research design is blue print for the collection, measurement and analysis of data.

2.7 LESSON END ACTIVITIES

Given the following decision problem, identify the research problem:

(i) Whether to change the compensation package of the sales force

(ii) Whether to increase the expenditure or print advertisement.

2.8 KEYWORDS

Research plan

Management problem

Problem formulation

Environmental factors

Mental map

Research cost

Market awareness

Distribution coverage

Market expenditure

Disguised

Probability sampling

Editing

Tabulating

Codifying

Research brief

Research

Pure research

Applied research

Ex-post-facto study

Descriptive research

Exploratory research

2.9 QUESTIONS FOR DISCUSSION

1. What is research methodology?
2. What are the questions posed for self in designing the research?
3. What are the steps involved in preparing the research plan?
4. Distinguish between management problem and research problem.
5. What is research brief?
6. What are the components of research brief ? Explain.
7. What is the difference between manager and researcher?

2.10 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007

Abrams, M.A, *Social Surveys and Social Action,* London: Heinemann, 1951.

Arthur, Maurice, *Philosophy of Scientific Investigation,* Baltimore: John Hopkins University Press, 1943.

Bernal, J.D., *The Social Function of Science,* London: George Routledge and Sons, 1939.

Chase, Stuart, *The Proper Study of Mankind:* An inquiry into the Science of Human Relations, New York, Harper and Row Publishers, 1958.

LESSON

3

SCIENTIFIC METHOD IN RESEARCH

CONTENTS

3.0 AIMS AND OBJECTIVES

In this lesson we will study various facets of scientific methods in research. After studying this lesson you will be able to:

(i) define scientific research.

(ii) differentiate between scientific and non-scientific methods of research.

(iii) describe characteristics of scientific methods in research.

3.1 INTRODUCTION

Scientific research is one which yields the same results when it is repeated by different individuals. The scientific method consists of the following steps.

(i) Systematic problem analysis;

(ii) model Building; and

(iii) Fact finding methods, used for the purpose of important decision-making and to regulate the marketing of goods and services.

3.2 PROCESS AND LOGIC IN SCIENTIFIC RESEARCH

1. ***Observation:*** The researcher wants to observe, a set of important factors that is related to his problem.

2. ***Formulates Hypothesis:*** The researcher formulates hypothesis, which will explain what he has observed
3. ***Future Prediction:*** The researcher draws a logical conclusion
4. ***Testing the hypothesis:*** Is the conclusion based on data

Example: A simple example will highlight, how a scientific method works. Let us assume that a researcher is conducting a market research project for a client manufacturing men's apparel.

1. ***Observation:*** Researcher observes that some of the competitors are doing a brisk business. Sales increase of apparel is mainly due to round or turtle neck shirt and narrow bottom pants.
2. ***Formulation of Hypothesis:*** Researcher now presumes that the product of his clients are somewhat similar and the variation in shirt and pant variety as above is the main cause for competitors sales increase.
3. ***Future prediction:*** It is predicted that if his client introduces same / similar products, sales will increase.
4. ***Hypothesis testing:*** The client now produces, round neck shirts and narrow bottom pants for test marketing.

3.3 CHARACTERISTICS OF SCIENTIFIC METHOD

(a) Validity

(b) Reliability

Validity is the ability of a measuring instrument to measure what it is supposed to measure. A questionnaire is administered to find the attitudes of the respondent towards a movie. So long as the questionnaire serves this purpose, we say that the instrument is valid.

In physical science, instrument used such as barometer, thermometer or scale measures what it is intended to do. Also measurement can be repeated any number of times by different individuals, the result will be the same.

3.4 WHY MR CANNOT BE CONSIDERED SCIENTIFIC

In M.R questionnaire is the instrument is used. There are five problems faced by researcher regarding validity and reliability.

1. Different respondent interpret the same question in different ways. So the reply of the respondent will be different
2. Whether sample is a representative of the population or not
3. Same questionnaire administered by different interviewers will yield different results.
4. Measuring instrument namely questionnaire may not state clearly what is being measured
5. Lab experiment is held under controlled condition. Such as temperature, humidity etc. in marketing research, it is not possible to control external environmental factors surrounding the study. Due to this, researcher may not be able to produce the same result.

Example 1: Respondent is interviewed on a specific subject. After about 60 days, the same respondent is interviewed once again. His reply could be very different from what he told first time. This may be because, he gathered additional information, or discussed the subject with others during this time period.

Reliability means, we must get the same result again and again when measured.

Example 2: Linear measurement using a scale, Velocity of light, sound in a given media, will be the same when measured repeatedly.

3.5 DISTINCTION BETWEEN SCIENTIFIC AND UNSCIENTIFIC METHOD

There are three major differences between scientific and unscientific method:

- Rational and objective
- Accuracy of measurement
- Maintaining continuity in investigation

3.5.1 Rational and Objective

Conclusions should be based on facts. Mindset should not influence decision making. E.g. When Howthorne studies started, it was thought that "employee satisfaction improved productivity". Later research proved otherwise. In fact, later, research indicated that productivity and employee satisfaction are not directly related. Similarly, in M.R, researcher should not proceed with preconceived notions. He must keep an open mind and be objective. Sometimes researcher approach respondents, who are easy to reach, and with whom, they are comfortable even though, they may not represent the true sample. In this case, objectivity is sacrificed.

3.5.2 Accuracy

Accuracy using scientific instrument can be ensured. This is because, the measuring instrument is valid and reliable. In M.R, Questionnaire is used to measure aspects such as attitude, preference etc. and this instrument is crude.

Example:

Habit such as smoking is measured using a scale such as

a. Often

b. Sometimes

c. More often than not

d. Rarely

e. Regularly

There are two aspects in the above questionnaire which may lead to inaccuracy.

(1) Respondents perception of what is asked

(2) What is the correct answer among the alternative

It is difficult to judge whether the respondent is answering correctly or not. Due to all there factors, accuracy had to be sacrificed.

3.5.3 Maintaining Continuity in Investigation

In science, there is continuity. This is because, every time there is an invention, the same is carried forward for further improving the same Example: Basic telephony Vs Latest mobile phones, early steam engines Vs Electronically driven engines. In M.R, there is less continuity. The present researcher does not start from where it was left out. Each project is independent. What is learnt in one assignment is not made use of in subsequent projects.

Due to all the above 3 reasons, we can conclude that M.R is not scientific.

Check Your Progress

1. Why MR cannot be considered scientific?
2. How can you maintain continuity in investigation?
3. What are the three differences between scientific and unscientific methods?

3.6 LET US SUM UP

The essence of scientific method are validity and reliability. Scientific method consists of observation, formulate hypothesis, future prediction, testing hypothesis. And marketing research lacks the same this is because marketing research is faced with several varying factors such as, instrument used to gather data, (Questionnaire) data interpretation, accuracy of sample selected etc., due to which validity and reliability suffers and hence considered unscientific. Also there are several other difficulties in applying scientific method in market research such as lack of continuity, investigators role, time pressure etc.

3.7 LESSON-END ACTIVITY

Considering the characteristics of scientific method, find out the difficulties in applying scientific methods to research in business and management.

3.8 KEYWORDS

Hypothesis

Validity

Reliability

Instrument

Precise

3.9 QUESTIONS FOR DISCUSSION

1. What is a scientific method?
2. What is validity and reliability? Give example.
3. "Search for facts should be made by scientific method rather than arbitrary method" substantiate the statement.
4. Distinguish scientific vs unscientific method.
5. The following words are commonly used in marketing. What is the meaning and importance of it.
   (a) Objective (b) Systematic (c) Decision-making
6. What is induction / deduction method of logical reasoning as applied to M.R?
7. Why marketing research cannot be considered scientific? Give reasons?
8. Describe the characteristics of scientific method?

3.10 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007

Abrams, M.A, *Social Surveys and Social Action,* London: Heinemann, 1951.

Arthur, Maurice, *Philosophy of Scientific Investigation*, Baltimore: John Hopkins University Press, 1943.

Bernal, J.D., *The Social Function of Science*, London: George Routledge and Sons, 1939.

Chase, Stuart, *The Proper Study of Mankind: An inquiry into the Science of Human Relations*, New York, Harper and Row Publishers, 1958.

LESSON

4

PROBLEMS IN RESEARCH

CONTENTS

4.0 AIMS AND OBJECTIVES

In this lesson we will study the problems in research and their origin, identifying research problem and its concepts, constructs and theoretical framework. After study this lesson you will be able to:

(i) formulate the research problem.

(ii) find sources of research problem.

(iii) learn the method of self questioning for defining the research problem.

4.1 INTRODUCTION

The first step in the research process consists of problem identifications. It is said that a problem identified in half solved. A research problem can be exploratory, descriptive or causal. Research problems related to different area of study have been discussed in this lesson in detail.

4.2 RETAILING

1. A survey on the factors that influence consumers to make their purchase from departmental store
2. The comparative analysis on the role of consumer loyalty towards organized and unorganized sector in retailing
3. Role of retailers in influencing consumers' buying decision – Food products
4. Consumer opinion on setting up a large departmental store
5. A survey on the impact of credit facilities by retailers to consumers in boosting the retail sales

4.3 CYBER-MARKETING

1. An opinion survey on the impact of internet in buying a product/service
2. A survey on analyzing of Internet users' preference on Horizontal portals
3. A survey on users' opinion about paid services (Bulk Mail storage & other value added services) over Internet
4. Role of internet in influencing consumer buying decision on consumer durable
5. A survey on analyzing the effectiveness local portals in influencing consumers to buy over internet

4.4 ADVERTISING & SALES PROMOTIONS

1. Effectiveness of print media on consumer buying decision-product to be selected by candidate
2. Effectiveness Outdoor media on consumer buying decision – product to be selected by candidate
3. Analysis on the relationship between leading TV serials and the effectiveness of advertisement in mass reach channel to be selected by candidate
4. Analysis on the effectiveness of dealer sales promotion in motivating the retailers – a company to be selected by candidate
5. Consumers' opinion on the influence of sales promotion on their buying decision-product to be selected by candidate

4.5 FMCG

1. Role of brand loyalty in influencing consumer buying decision – Cosmetics
2. Analysis on the effectiveness of small packets in boosting consumers' consumption pattern-a product to be selected by candidate
3. Analysis on the frequency of consumers' consumption pattern-toilet products
4. Comparative analysis on the consumer preference on buying the national and store brands of grocery products – Atta
5. Survey on the factors that influence the consumer preference of brands and consumption pattern-biscuits

4.6 CONSUMER DURABLES

1. Analysis on the relationship between price and features in influencing consumer buying decision – product to be selected by candidate
2. Analysis on the consumers' opinion on exchange promotion scheme-Television
3. Comparative analysis on the factors and consumer preference to buy two-wheelers -Victor v/s Passion
4. Analysis on the decision-making pattern in a family in buying consumer durables
5. Analysis on the consumer's opinion on buying extra Television to a home in the emerging scenario of multiple private channels

4.7 PRODUCTION MANAGEMENT

1. Manufacturing Process
2. Plan Layout study
3. Material Handling facilities Vs Cost saving
4. Production Planning & Control – Various functions
5. Production Scheduling
6. Resource Planning – Use of software
7. Shop Floor Planning & Control – Stage-wise progress study
8. Quality Control – Methods, tools adopted
9. Materials management – Procurement process
10. Purchasing, Purchasing policies
11. Materials Storing methods
12. Inventory Management – E.g. JIT, ABC or VED analysis

4.8 FINANCIAL MANAGEMENT

1. Collection Mechanism adopted by the organization
2. Credit Policies Adopted
3. Inventory Management Practices followed by the organization
4. Banking Operations of Financial Transactions
5. Funds flow and Cash flow exercises
6. Budgetary Control in operation
7. Taxation – Corporate & Excise
8. Determination of cost production – procedures & practices
9. Internal Audit & Control mechanism adopted
10. Mobilisation & Deployment of Funds
11. Mutual Fund Performance evaluation
12. Investors Perception about any given financial products/services
13. Branch Profitability of a particular Bank
14. Working Capital Management
15. Housing loan Bank performance evaluation
16. Evaluation of Insurance Schemes
17. Awareness of Derivative Trading practice

4.9 IDENTIFYING RESEARCH PROBLEM

There is a famous saying that “Problem well defined is half solved”. This statement is true in market research because if the problem is not stated properly, the objectives will not be clear. Once objective is not clearly defined, data collection becomes meaningless.

The first step in research is to formulate the problem. A company manufacturing TV might think that it is loosing its sales to a foreign company. The following illustration

shows, "How problem could be ill conceived" Management of the company felt that, this was due to its poor product quality. Subsequently research was undertaken with a view to improve the quality of the product. Despite quality improvement, the sales did not increase. In this case we may say that 'the problem is ill defined". The real reason was "Ineffective sales promotion". So, problem needs to be identified with care.

Problem definition might refer to either a real life situation or it may also refer to a set of opportunities. Market research problem or opportunities will arise under the following circumstances (1) Unanticipated change (2) Planned change. Many factors in the environment can create problems or opportunities. Thus, change in the demographics, technological, legal changes, affect the marketing function. Now the question is "How the company responds to new technology", or "New product introduced by competitor" or "How to cope up with changes in the life style". It may seem to be problem and at the same time, it can also be viewed as an opportunity. In order to conduct research, problem must be defined accurately.

While formulating the problem, clearly define,

1. Who is the focus?
2. What is the subject matter of research?
3. To which geographical territory / area the problem refers to?
4. To which period the study pertains to?

Example: "Why is it the upper middle class of Bangalore shop at "Life style" during Diwali season".

Here all the above 4 aspects are covered. We may be interested in a no. of variables due to which shopping is done at a particular place. The characteristic of interest to the researcher may be (1) Variety offered at Life style (2) Discount offered by way of promotion (3) Ambiance at Life style (4) Personalised service offered. In some cases, the cause of the problem is obvious and in some other case, the cause of the problem is not so obvious. The obvious causes are "Product is on the decline". Not so obvious causes are "Bad first experience by the customer".

4.10 SOURCES FOR PROBLEM IDENTIFICATION

Research students can adopt the following ways to identify the problems.

- Research reports already published may be referred to define a specific problem.
- Assistance of research organisation, which handles a number of projects of the companies, can be sought to identify the problem.
- Professors, working in reputed academic institution can act as guides in problem identification.
- Company employees and competitors can assist in identifying the problems.
- Cultural changes and Technological changes can act as a sources for research problem identification.
- Seminars / symposiums / focus groups can act as a useful source.

4.11 SELF QUESTIONING BY RESEARCHER WHILE DEFINING THE PROBLEM

1. Is the research problem correctly defined?
2. Is the research problem solvable?

3. Can relevant data be gathered through the process of marketing research?
4. Is the research problem significant?
5. Can the research be conducted within the resource available?
6. Is the time given to complete the project is sufficient?
7. What exactly will be the difficulties in conducting the study, and hurdles to overcome?
8. Am I competent to carry out the study?

Managers often want the results of research, in-line with their expectations. This satisfies them immensely. If one were to closely look at the questionnaire, it is found that in most cases there are stereotyped answers given by respondents. A researcher must be creative and should look at problems in a different perspective.

4.12 CONCEPTS

The terms concepts and constructs though have similar meanings, yet there is some difference between the two. A concepts is a word or set of words that express a general idea concerning the nature of thing or the relations between things. Often providing a category for the classification of phenomena. Concepts provide a means of ordering the vast diversity of empherical phenomena. However concepts are not inherent in nature itself but are man made for example personality, family, society, event, status, change, growth etc. are all concepts.

Concepts are explained through definitions for example investor, carries many meaning, corporate investor, retail investor, individual investor etc. so, it has to be explained through clear definitions to avoid the misunderstanding of the concept of the research under study.

The role of concepts is to establish some kind of link with the social world. Concepts are regarded very imp. In the theoretical frame work that sets a context for the research, as being involved in the statement of a research problem, hence it helps to specify what type of data to be collected, from whom data to be collected etc.

4.13 CONSTRUCTS

A construct is a concept devised to aid in scientific analysis and generalization, thus a construct is a concept with the added meaning of having been deliberately and consciously invented or adopted for a special scientific purpose for example " intelligence" is a concept and " intelligence quotient" (IQ) is a scientific construct, which enables behavioral scientist to measure the intelligence of a person.

4.14 THEORETICAL FRAMEWORK

A theoretical framework is a collection of interrelated concepts, like a theory but not necessarily so well worked-out. A theoretical framework guides your research, determining what things you will measure, and what statistical relationships you will look for.

Theoretical frameworks are obviously critical in deductive, theory-testing sorts of studies (see Kinds of Research for more information). In those kinds of studies, the theoretical framework must be very specific and well-thought out.

Surprisingly, theoretical frameworks are also important in exploratory studies, where you really don't know much about what is going on, and are trying to learn more. There

are two reasons why theoretical frameworks are important here. First, no matter how little you think you know about a topic, and how unbiased you think you are, it is impossible for a human being not to have preconceived notions, even if they are of a very general nature. For example, some people fundamentally believe that people are basically lazy and untrustworthy, and you have keep your wits about you to avoid being conned. These fundamental beliefs about human nature affect how you look things when doing personnel research. In this sense, you are always being guided by a theoretical framework, but you don't know it. Not knowing what your real framework is can be a problem. The framework tends to guide what you notice in an organization, and what you don't notice. In other words, you don't even notice things that don't fit your framework! We can never completely get around this problem, but we can reduce the problem considerably by simply making our implicit framework explicit. Once it is explicit, we can deliberately consider other frameworks, and try to see the organizational situation through different lenses.

Check Your Progress

1. Problem well defined is half solved. Justify it.
2. How theoretical frameworks are important in exploratory studies?

4.15 LET US SUM UP

Proper problem formulation is the key to success in research. It is vital and any error in defining the problem incorrectly can result in wastage of time and money. Several elements of introspection will help in defining the problem correctly.

4.16 KEYWORDS

Retailing

Cyber Marketing

FMCG

Advertising

Sales Promotion

4.17 QUESTIONS FOR DISCUSSION

1. What is a concept?
2. What is a construct?
3. What do you mean by theoretical framework in research?
4. What is a research problem?
5. What are the steps involved in formulating the problem?
6. What are the sources of problem?
7. What are the questions posed for self while formulating the problem?

4.18 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods*, Excel Books, 2007

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases"*, All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision-making"*, Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology - Methods and Techniques"*, Wiley Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics"*, D.B. Taraporevala Sons and Co. Private Limited, Bombay.

UNIT-II

LESSON

5

HYPOTHESIS

CONTENTS

5.0 AIMS AND OBJECTIVES

In this lesson we will study the meaning, source and types of hypothesis and formulation and types of research design. After studying this chapter you will be able to:

(i) define hypothesis.

(ii) describe source of hypothesis.

(iii) distinguish between different types of hypothesis.

(iv) formulate research design type

(v) describe different methods of exploratory research.

5.1 INTRODUCTION

Inferences on population parameters are often made on the basis of sample observation. In doing so, one has to take the help of certain assumptions or hypothetical values about the characteristics of the population if some such information is available. Such hypothesis about the population is termed as statistical hypothesis and the hypothesis is tested on the basis of sample values. The procedure enables one to decide on a certain hypothesis and test its significance.

5.2 MEANING OF HYPOTHESIS

A hypothesis is a tentative proposition relating to certain phenomenon, which the researcher wants to verify when required.

If the researcher wants to infer something about the total population from which the sample was taken, statistical methods are used to make inference. We may say that, while a hypothesis is useful, it is not always necessary. Many a time, the researcher is interested in collecting and analysing the data indicating the main characteristics without a hypothesis. Also, a hypothesis may be rejected but can never be accepted except tentatively. Further evidence may prove it wrong. It is wrong to conclude that since hypothesis was not rejected it can be accepted as valid.

What is a null hypothesis?

A null hypothesis is a statement about the population, whose credibility or validity the researcher wants to assess based on the sample.

A null hypothesis is formulated specifically to test for possible rejection or nullification. Hence the name 'null hypothesis'. Null hypothesis always states "no difference". It is this null hypothesis that is tested by the researcher.

5.3 SOURCES OF HYPOTHESIS

Hypothesis can be derived from many sources

1) Theory
2) Observation
3) Past experience
4) Case studies
5) Similarity

1) ***Theory:*** Theory on the subject can act as a source of hypothesis. We start of from a general premise and then formulate hypothesis.

Example: Providing employment opportunity is an indicator of social responsibility of a government enterprise. From the above several hypothesis, it can be deduced that:-

1) Public enterprise has greater social concern than other enterprises.
2) Peoples perception of government enterprise is social concern.
3) Govt. enterprise help in improving the life of less privileged people.

2) ***Observation:*** Peoples' behaviour is observed. In this method we use observed behaviour to infer the attitudes. This an indirect method of attitude measurement. Direct observation is used to get insights into research behaviour and other related issues.

Example: A shopper in a supermarket may be disguised, to watch the customer in the stores. The following may be observed. (a) How the customer approaches the - Product category, (b) How long he/she spends in front of display, (c) Whether the customer had difficulty in locating the product. Collect all these data and formulate a hypothesis regarding the behaviour of the customer towards the product.

3) ***Past experience:*** Here researcher goes by past experience to formulate the hypothesis.

Example: A dealer may state that fastest moving kids apparel is frock. This may be verified.

4) ***Case studies:*** Case studies published can be used as a source for hypothesis. Normally this is done before the launch of a product to find customer taste and preferences.

5) ***Similarity:*** This could be with respect to similarity in activities of human beings.

Example: Dress, food habits or any other activities found in human living in different parts of the globe.

5.4 TYPES OF HYPOTHESIS

There are several basis on which hypothesis are classified

a. Descriptive Hypothesis

b. Relational Hypothesis

5.4.1 Descriptive Hypothesis

These by name implies describing some characteristics of an object, a situation, an individual or even an organization

Example:

1. Students from autonomous institutions are placed faster than other institutions.
2. Research and practice of educations system in our country is not integrated.
3. Why do youngsters prefer "X" soft drinks?
4. Decentralization of decision-making is more effective.

The above description tells us the characteristics of some entity.

5.4.2 Relational Hypothesis

In this case, we describe relationship between 2 variables.

1. Why do rich people shop at life style?
2. Rate of attrition is high in those jobs where there is night shift working.
3. More cohesive is the group, better is the output.

5.4.3 Working Hypothesis

This is a hypothesis framed in the early stages of research. These are altered or modified as investigation proceeds.

Example: As of now "demand and quality are related". Later on this may not be the fact as investigation proceeds.

5.4.4 Null Hypothesis

This hypothesis states that there is no difference between the parameter and the statistic that is being compared.

Example: There is no relationship between marks obtained in the examination and the success of the same student in the corporate world. Null hypothesis are framed for testing statistical significance. Null hypothesis is very exact.

5.4.5 Analytical Hypothesis

Here relationship of analytical variable is found. These are used when one would like to specify the relationship between changes in one property leading to change in another.

Example: Income level related to number of children in the family or literacy related to number of children in the family.

5.4.6 Statistical Hypothesis

These are got from samples that are measurable. Statistical hypothesis are of 2 types:

(a) Hypothesis which indicates differences.

Example: There is a difference between the performance of students graduating from English medium schools and those of others.

(b) Hypothesis which indicates association

Example: There is a perfect relationship between price and demand.

5.4.7 Common Sense Hypothesis

There are based on what is being observed. (1) Junior students are more disciplined than seniors (2) Economically poor students work hard compared to those, who come from well to do families (3) Middle class families lead a humble living. The above are observed on a day to day basis over a period of time before drawing any conclusions.

5.5 FORMULATION OF RESEARCH DESIGN TYPES

Exploratory Research

The major emphasis in exploratory research is to convert broad, vague, problem statements into small, precise sub problem statement, which is done in order to formulate specific hypothesis. The hypothesis is a statement that specifies. "How two or more variables are related?"

In the early stages of research, we usually lack sufficient understanding of the problem to formulate a specific hypothesis. Further, there are often several tentative explanations. Example: "Sales are down because our prices are too high". "Our dealers or sales representatives are not doing a good job", "our advertisement is weak" and so on. In this scenario, very little information is available to point out, which is the actual cause of the problem. Therefore we can say that, the major purpose of exploratory research is to identify the problem more specifically. Therefore exploratory study is used in initial stages of the research.

5.6 UNDER WHAT CIRCUMSTANCES EXPLORATORY STUDY IS IDEAL?

The following are the circumstances, exploratory study would be ideally suited.

- To gain insight into the problem.
- To generate new product ideas.
- To list all possibilities. Among the several possibilities, we need to prioritize the possibilities which are seemingly likely.
- Some times to develop hypothesis.
- Exploratory study is also used to increase the analysts familiarity with the problem. This is particularly true, when the analyst is new to the problem area. Example: A market researcher working for a company for the first time (new entrant).
- To establish priorities so that further research can be conducted.
- Exploratory study, may be used to clarify concepts and help in formulating precise problems. Example: Management is considering a change in the contract policy, which it hopes, will result in improved channel members satisfaction. Exploratory study can be used to clarify the present understanding and channel members satisfaction and to develop a method by which satisfaction level of channel members is measured.
- To pretest a draft questionnaire
- In general, exploratory research is appropriate to any problem about which very little is known. This research is the foundation for future study.

5.7 HYPOTHESIS DEVELOPMENT AT EXPLORATORY RESEARCH STAGE

At exploratory stage,

1. Sometimes it may not be possible to develop any hypothesis at all, if it is being investigated for the first time. This is because no previous data is available.
2. Some times, some information may be available and it may be possible to formulate a tentative hypothesis.
3. In some other cases, most of the data is available and it may be possible to provide answer to the problem.

The examples given below indicates each of the above type:

Research Purpose	Research Question	Hypothesis
1) What product feature, if stated will be most effective in the advertisement?	What benefit do people derive from this Ad appeal?	No hypothesis formulation is possible.
2) What new packaging is to be developed by the company? (with respect to a soft drink)	What alternatives are there to provide a container for soft drink?	Paper cup is better than any other forms, such a can or a Bottle.
3) How can our insurance service be improved?	What is the nature of customer dissatisfaction?	Impersonalization is the problem.

In example 1, research question is to determine "What benefit people seek from the Ad?" Since no previous research is done on consumer benefit for this product, it is not possible to form any hypothesis.

In example 2, currently some information is available about packaging for a soft drink. Here it is possible to formulate a hypothesis which is purely tentative. The hypothesis formulated here, may be only one of the several alternatives available.

In example 3, the root cause of customer dissatisfaction is known, i.e. lack of personalized service. In this case, it is possible to verify whether this is a cause or not.

5.8 EXPLORATORY RESEARCH METHODS

The quickest and the cheapest way to formulate a hypothesis in exploratory research is by using any of the four methods.

- Literature search
- Experience survey
- Focus group
- Analysis of selected cases

5.8.1 Literature Search

This refers to "Referring to a literature to develop a new hypothesis". The literature referred are, trade journals, professional journals, market research finding publications, statistical publications etc. Example: Suppose a problem is "Why sales are down?" This can quickly be analysed with the help of published data which should indicate "Whether the problem is an "Industry problem" or a "Firm problem". Three possibilities are there to formulate the hypothesis.

1. The company's market share has declined but industry is doing normal.
2. The industry is declining and hence the company's market share is also declining.
3. The industry's share is going up but the company's share is declining.

If we accept the situation that, our company's sales are down despite the market having upward trend, then we need to analyze the marketing mix variables.

Example 1: . A TV manufacturing company feels that its market share is declining whereas the overall TV industry doing very well.

Example 2: . Due to trade embargo by a country, textiles export is down and hence sale of company making garment for exports is on the decline.

The above information may be used to locate the reason for declining sales.

5.8.2 Experience Survey

In experience survey, it is desirable to talk to persons who are well informed in the area being investigated. These people may be company executives or persons outside the organization. Here no questionnaire is required. The approach adopted in an experience survey should be highly unstructured, so that the respondent can give divergent views. Since the idea of using experience survey is problem formulation, and not conclusion, probability sample need not be used. Those who cannot speak freely should be excluded from the sample.

Example 1: A group of housewives may be approached towards their choice for a "Ready to cook product".

Example 2: A publisher might want to find out the reason for poor circulation of news paper introduced recently. He might meet (a) News paper sellers (b) Public reading room (c) General public (d) Business community etc.

These are experienced persons, whose knowledge researcher can use.

5.8.3 Focus Group

Another widely used technique in exploratory research is focus group. In focus group, a small number of individuals are brought together to study and talk about some topic of interest. The discussion is directed by a moderator. The group usually is of 8 - 12 persons. While selecting these persons, care is to be taken to see that, these persons have a common background and have similar experience in buying. This is required because, there should not be a conflict among the group members, on the common issues that are being discussed. During the discussion, future buying attitude, present buying opinion etc., are gathered.

Most of the companies conducting the focus groups, first screen the candidates to determine, who will compose the particular group. Firms also make sure to avoid groups, in which, some of the participants have their friends and relatives, because this leads to a biased discussion. Normally a number of such groups are constituted and the final conclusion of various groups are taken for formulating the hypothesis. Therefore a key factor, in focus group is to have similar groups. Normally there are 4-5 groups. Some of them may even have 6 - 8 groups. The guiding criteria is to see, whether the latter groups are generating additional ideas or repeating the same, with respect to subject under study. When this shows a diminishing return from the group, the discussions are stopped. The typical focus group lasts for 1:30 hours to 2 hours. The moderator, under the focus group has a key role. His job is to guide the group, to proceed in the right direction.

The following should be the characteristics of the moderator/facilitator:

Listening: He must have good listening ability. The moderator must not miss the participants comment, due to lack of attention.

Permissive: Moderator must be permissive, yet alert to the signs that the group is disintegrating.

Memory: He must have a good memory. The moderator must be able to remember the comments of the participants. Example: Discussion is centered around a new advertisement by a telecom company. The participant may make a statement early and make another statement later, which is opposite to what was told earlier. Example: The participant may say that he/she never subscribed to the views expressed in the advertisement by the competitor, but subsequently may say that the "current advertisement of competitor is excellent"

Encouragement: The moderator must encourage unresponsive members to participate.

Learning: He should be a quick learner.

Sensitivity: The moderator must be sensitive enough to guide the group discussion.

Intelligence: He must be a person whose intelligence is above average.

Kind / firm: He must combine detachment with empathy.

Variations of focus group

- ***Respondent moderator group:*** In this method, the moderator will select one of the participant to act as moderator temporarily
- ***Dueling Moderator group:*** In this method there are two moderators. They purposely take opposite position on a given topic. This will help the researcher to get the views of both the group.
- ***Two way focus group:*** In this method, one group will listen to the other group. Later the second group will react to the views of first group.
- ***Dual Moderator group:*** Here also there are two moderators. One moderator will make sure that the discussion moves smoothly. Second moderator will ask specific question.

5.8.4 Analysis of Selected Cases

Analysing a selected case, some times gives an insight into the problem which is being researched. Case histories of the companies which have undergone a similar situation may be available. These case studies are well suited to do exploratory research. However, the result of investigation of case histories are always considered as suggestive, rather than conclusive. In case of preference to "ready to eat food", many case histories may be available in the form of previous study made by the competitors. We must carefully examine the already published case study with regard to other variables such as price, advertisement, changes in the taste etc.

5.9 CONCLUSIVE RESEARCH

Meaning: This is a research having clearly defined objectives. In this type of research, specific courses of action is taken to solve the problem.

In conclusive research, there are two types

(a) Descriptive research

(b) Experimental research or Casual research.

Descriptive Research

Meaning

(a) The name itself tells that, it is essentially a research to describe something. Example: It can describe, the characteristics of a group such as customers, organisation,

markets etc. Descriptive research provides "association between two variables". E.g. Income and place of shopping, age and preference.

(b) Descriptive study can tell us proportions of high and low income customer in a particular territory. What descriptive research "cannot" indicate is that it cannot establish cause and effect relationship between the characteristics of interest. This is the one distinct disadvantage of descriptive research.

(c) Descriptive study requires a clear specification of "Who, what, when, where, why and how" of the research. Example: Consider a situation of convenience stores (food world) planning to open a new outlet. The company wants to determine, "How people come to patronize a new outlet?" Some of the questions that need to be answered before data collection for this descriptive study is as follows:

Who? Who is considered as a shopper responsible for the success of the shop, whose demographic profile is required by the retailer.

What? What characteristics of the shopper should be measured?

Is it the age of the shopper, sex, income or residential address?

When? When shall we measure?

Should the measurement be made while the shopper is shopping or at a later time?

Where? Where shall we measure the shoppers?

"Should it be outside the stores, soon after they visit" or should we contact them at their residence?

Why? Why do you want to measure them?

What is the purpose of measurement? Based on the information, are there any strategy which will help the retailer to boost the sales? Does the retailer want to predict future sales based on the data obtained.

Answer to some of the above questions will help us in formulating the hypothesis.

How to measure? "Is it a structured questionnaire", 'disguised' or 'undisguised' questionnaire?

When to use descriptive study?

- To determine the characteristics of market such as
  - (a) Size of the market
  - (b) Buying power of the consumer
  - (c) Product usage pattern
  - (d) To find market share for the product
- To determine the association of the two variables such as Ad and sales.
- To make a prediction. We might be interested in sales forecasting for the next three years, so that we can plan for training of new sales representatives.
- To estimate the proportion of people in a specific population, who behave in a particular way. Example: What percentage of population in a particular geographical location would be shopping in a particular shop.

Hypothesis study at descriptive research stage (To show characteristics of the group)

Management problem	Research problem	Hypothesis
How should a new product be distributed?	Where do customers buy a similar product right now?	Upper class buyers use 'Shopper's Stop' and middle class buyers buy from local departmental stores.
What will be the target segment?	What kind of people buys our product now?	Senior citizens buy our product. Young and married buy our competitors products.

Types of descriptive studies: There are two types of descriptive research,

(a) **Longitudinal study**

(b) **Cross sectional study**

(a) ***Longitudinal Study: These*** are the studies in which an event or occurrence is measured again and again over a period of time. This is also known as 'Time Series Study'. Through longitudinal study, the researcher knows " How market changes over time".

Longitudinal studies involve panels. Panel constituted, will have elements. These elements may be individuals, stores, dealers etc. The panel or sample remains constant throughout the period of the study. There may be some drop-outs and additions. The sample members in panel are measured repeatedly. The periodicity of the study may be monthly or quarterly etc. There are 2 types of panels.

- True panel
- Omni bus panel.

True panel: This involves repeat measurement of the same variables. Example: Perception towards frozen pea or iced tea. Each member of the panel are examined at different time, to arrive at a conclusion on the above subject.

Omni bus panel: In omni bus panel also, a sample of elements is selected and maintained, but the information collected from the member varies. At a certain point of time, attitude of panel members "towards an advertisement" may be measured. At some other point of time the same panel member may be questioned about the "product performance".

Advantages of panel data

- We can find out what proportion of those who bought our brand and those who did not. This is computed using brand switching matrix.
- The study also helps to identify and target the group which needs promotional effort.
- Panel members are willing persons, hence lot of data can be collected. This is because, becoming a member of a panel is purely voluntary.
- The greatest advantage of panel data is that, it is analytical in nature.
- panel data is more accurate than cross sectional data because, it is free from the error associated with reporting past behavior. Errors occur in past behavior because of time that has elapsed or forgetfulness.

Disadvantages of panel data

- The sample may not be a non representative. This is because, some times, panels may be selected on account of convenience.
- The panel members, who provide the data, may not be interested to continue as panel members. There could be dropouts, migration etc. Replacement member may not be a replica of the original member.
- Reward given to panel members may not be attractive. Therefore people may not like to be panel members.
- Some times the panel members may show disinterest and non commitment.
- Lengthy membership in a panel, cause respondents to start thinking that, they are experts and professionals. They may start responding like experts and consultants and not like respondents. To avoid this, no one should be retained as a member for more than 6 months.

(b) ***Cross Sectional Study:*** Cross sectional study is one of the most important types of descriptive research, it can be done in two ways

- **Field study**
- **Field survey**

Field study: Includes a depth study. Field study involves in-depth study of a problem such as reaction of young men and women towards a product. Example: Reaction of Indian men towards branded ready to wear suit. Field study is carried out in real world environment settings. Test marketing is an example of field study.

Field survey: Large sample is the feature of the study. The biggest limitation of this survey is cost and time. Also if the respondent is cautious, then he might answer the questions in a different manner. Finally field survey requires good knowledge like constructing questionnaire, sampling techniques used etc.

Example: Suppose the management believes that geographical factor is an important attribute in determining the consumption of a product. Sales of a woolen wear in a particular location. Suppose that the proposition to be examined is that, urban population is more likely to use the product, than the semi urban population. This hypothesis can be examined in a cross sectional study. Measurement can be taken from a representative sample of the population in both geographical location with respect to the occupation and use the products. In case of tabulation, researcher can count the number of cases that fall into each of the following classes:

- Urban population who use of the product - Category I
- Semi-urban population who use of the product - Category II
- Urban population who do not use the product - Category III
- Semi-urban population who do not use the product - Category IV

Here, we should know that, if the hypothesis is to be supported and tested by the sample data i.e. Proportion of urbanities using the product should exceed the Semi urban population using the product.

5.10 LET US SUM UP

The chapter deals with two types of research namely exploratory research and descriptive research Exploratory research helps the researcher to become familiar with the problem. It helps to establish the priorities for further research. It may or may not be possible to formulate Hypothesis during exploratory stage. To get an insight into the problem, literature search, experience surveys, focus groups, and selected case studies assist in gaining insight into the problem. The role of moderator or facilitator is extremely important in focus group. There are several variations in the formation of focus group.

Descriptive research is rigid. This type of research is basically dependent on hypothesis. Descriptive research is used to describe the characteristics of the groups. It can also be used forecasting or prediction. Panel data is used in longitudinal studies. There are 2 different types of panels. True panel and Omni bus panel.

In true panel same measurement are made during period of time. In Omni bus panel different measurement are made during a period of time. Cross sectional studies involves field study and field survey, the difference being the size of sample.

What hypothesis would you use in the following situation?

"An automobile company has manufacturing facility at two different models. The customer wants to know if the milage given by both the models is the same or not."

5.11 LESSON-END ACTIVITY

What hypothesis would you use in the following situation?

"An automobile company has manufacturing facility at two different models. The customer wants to know if the milage given by both the models is the same or not."

5.12 KEYWORDS

Exploratory research

Descriptive research

Conclusive research

Focus group

Moderator

Longitudinal study

Cross sectional study

True panel

Omni bus panel

Field study

Field survey

5.13 QUESTIONS FOR DISCUSSION

1. What are the types , sources and characteristics of hypothesis?
2. Why is research design necessary to conduct a study?
3. What are the various types of research design? Explain with examples.
4. What is exploratory research? Give example, under what circumstances, exploratory research is ideal?
5. What are the sources available for data collection at exploratory stage?
6. What are the different variations in the focus group?
7. What are the characteristics that a moderator should possess while conducting the focus group?
8. What are the uses of descriptive research and when will it be used?
9. What are the various types of descriptive studies?
10. What are the Longitudinal and Cross Sectional Studies?
11. Describe the various types of panels and its use.
12. What is a Sample survey? What are its benefits:
13. What are the various types of cross sectional studies? What are the benefits and limitations of each?
14. Distinguish exploratory from descriptive research.
15. What are the advantages and disadvantages of panel data?

5.14 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Festinger, Leon and Katz, Daniel, *Research Methods in the Behavioural Sciences,* New York: Holt, Rinehart and Winston.

Fox, David J, *The Research Process in Education*, New York: Holt, Rinehart and Winston.

Green, Paul, and Tull, Donald, *Research for marketing decisions,* Englewood, N.J., Prentice-Hall.

Selltiz, Claire et al., *Research Methods in Social Relations,* New York: Holt, Rinehart and Winston.

LESSON

6

CAUSAL RESEARCH

CONTENTS

6.0 AIMS AND OBJECTIVES

In this lesson we study the systematic approach in solving a research problem variables of which establish the cause and effect relationship. After studying this lesson you will be able to:

(i) understand what is causal research.

(ii) solve the research problem systematically.

(iii) describe different types of experimental designs.

6.1 INTRODUCTION

Causal research establishes cause and effect relationship between the variables. In this type of research, there are three types of variables: explanatory variables, dependent variables and extraneous variables. To find the causal relationship between the variables, the researcher has to do an experiment. All these are studied in detail, in this lesson.

6.2 CAUSAL RESEARCH OR EXPERIMENTAL RESEARCH

Descriptive research, will suggest the relationship if any between the variable, but it will not establish cause and effect relationship between the variable. Example: The data collected may show that the no. of people who own a car and their income has risen over a period of time. Despite this, we cannot say "No. of car increase is due to rise in the income". May be, improved road conditions or increase in number of banks offering car loans have caused in increase in the ownership of cars.

(a) Sometimes, marketing manager wants to draw certain conclusions such as:

(1) Impact of retail price on sales

(2) Effect of Advertising on the sales of a product

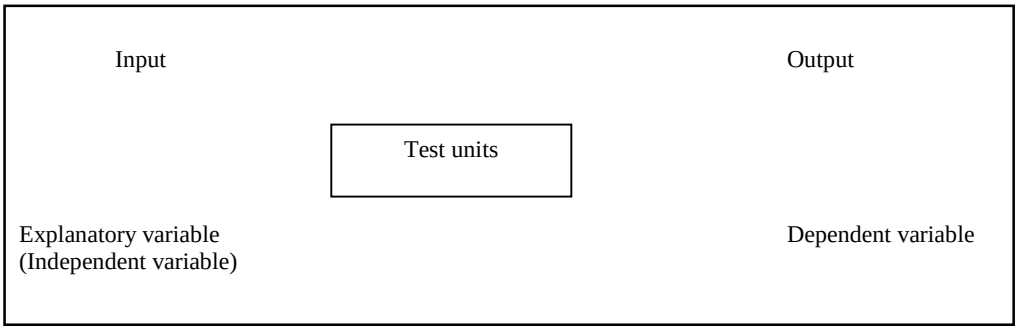
(3) Effect of improved packing on sales.

To find the causal relationship between the variables, the researcher has to do an experiment.

Examples of experimentation:

- Which print advertisement is more effective? Is it front page, middle page or the last page?
- Among several promotional measure, such as Advertisement, personal selling, "which one is more effective"?
- Can we increase sales of our product by obtaining additional shelf space?

(b) What is experimentation? It is research process in which one or more variables are manipulated, which shows the cause and effect relationship. Experimentation is done to find out the effect of one factor on the other. The different elements of experiment are explained below.



6.2.1 Test Units

These are units, on which the experiment is carried out. It is done, with one or more independent variables controlled by a person to find out its effect, on a dependent variable.

6.2.2 Explanatory Variable

These are the variables whose effects, researcher wishes to examine Example: Explanatory variables may be advertising, pricing, packaging etc.

6.2.3 Dependent Variable

This is a variable which is under study. Example: Sales, Consumer attitude, Brand loyalty etc.

Example: Suppose a particular colour TV manufacturer reduces the price of the TV by 20%. Assume that his reduction is passed on to the consumer and expect the sales will go up by 15% in next 1 year. This types of experiments are done by leading TV companies during festival season

The causal research finds out, whether the price reduction causes an increase in sales.

6.2.4 Extraneous Variables

These are also called as blocking variables Extraneous variables affects, the result of the experiments.

Example 1: Suppose a toffee manufacturing company is making an attempt to measure the response of the buyers, on two different types of packaging, at two different locations. The manufacturer needs to keep all other aspects the same, for each buyers group. If the manufacturer allows the extraneous variable namely the "Price", to vary between the two buyer groups, then he will not be sure, as to which particular packaging is preferred by the consumers. Here prices change is an extraneous factor.

There are two possible courses of action with respect to extraneous variables.

Extraneous variables may be physically controlled. Example: Price in the above example.

In the second category, extraneous variables may be totally out of control of the researcher. In this case, we say that the experiment has been confounded i.e., it is not possible to make any conclusions with regard to that experiment. Such a variable is called as "Confounding variables".

Example 2: Company introduces a product in two different cities. They would like to know the impact of their advertising on sales. Simultaneously competitors product in one of the cities is not available during this period due to strike in the factory. Now researcher cannot conclude that sales of their product in that city has increased due to advertisement. Therefore this experiment is confounded. In this case, strike is the confounding variable.

6.3 TYPES OF EXTRANEOUS VARIABLES

The following are the various types:

- History
- Maturation
- Testing
- Instrument variation
- Selection bias
- Experimental mortality

6.3.1 History

History refers to those events, external to the experiment, but occurs at the same time, as the experiment is being conducted. This may affect the result. Example: Let us say that, a manufacture makes a 20% cut in the price of a product and monitors sales in the coming weeks. The purpose of the research, is to find the impact of price on sales. Mean while if the production of the product declines due to shortage of raw materials, then the sales will not increase. Therefore, we cannot conclude that the price cut, did not have any influence on sales because the history of external events have occurred during the period and we cannot control the event. The event can only be identified.

6.3.2 Maturation

Maturation is similar to history. Maturation specifically refers to changes occurring within the test units and not due to the effect of experiment. Maturation takes place due to passage of time. Maturation refers to the effect of people growing older. People

may be using a product. They may discontinue the product usage or switch over to alternate product.

***Example 1*:** Pepsi is consumed when young. Due to passage of time the consumer becoming older, might prefer to consume Diet pepsi or even avoid it.

***Example 2*:** Assume that training programme is conducted for sales man, the company wants to measure the impact of sales programme. If the company finds that, the sales have improved, it may not be due to training programme. It may be because, sales man have more experience now and know the customer better. Better understanding between sales man and customer may be the cause for increased sales.

Maturation effect is not just limited to test unit, composed of people alone. Organizations also changes, dealers grow, become more successful, diversify, etc.

6.3.3 Testing

Pre testing effect occurs, when the same respondents are measured more than once. Responses given at a later part will have a direct bearing on the responses given during earlier measurement.

Example: Consider a respondent, who is given an initial questionnaire, intended to measure brand awareness. After exposing him, if a second questionnaire similar to the initial questionnaire is given to the respondent, he will respond quiet differently, because of respondent's familiarity with the earlier questionnaire.

Pretest suffers from internal validity. This can be understood through an example. Assume that a respondent's opinion is measured before and after the exposure to a TV commercial of Hyundai car with Shahrukh Khan as brand ambassador. When the respondent is replying the second time, He may remember, how he rated Hyundai during the first measurement. He may give the same rating to prove that, he is consistent. In that case, the difference between the two measurements will reveal nothing about the real impact.

Alternately some of respondents might give a different rating during second measurement. This may not be due to the fact that the respondent has changed his opinion about Hyundai and the brand ambassador. He has given different rating because, he does not want to be identified as a person with no change of opinion to the said commercial.

In both the cases of above, internal validity suffers.

6.3.4 Instrument Variation

Instrument variation effect is a threat to internal validity when human respondents are involved. Example: An equipment such as a vacuum cleaner is left behind, for the customer to use for two weeks. After two weeks the respondents are given a questionnaire to answer. The reply may be quite different from what was given by the respondent before the trail of the product. This may be because of two reasons.

(1) Some of the questions have been changed

(2) Change in the interviewer for pre testing and post testing are different

The measurement in experiments will depend upon the instrument used to measure. Also results may vary due to application of instruments, where there are several interviewers. Thus, it is very difficult to ensure that all the interviewers will ask the same questions with the same tone and develop the same rapport. There may be difference in response, because each interviewer conducts the interview differently.

6.3.5 Selection Bias

Selection bias occurs because 2 groups selected for experiment may not be identical. If the 2 groups are asked various questions, they will respond differently. If multiple groups are participating, this error will occur. There are two promotional advertisement A & B

for "Ready to eat food". The idea is to find effectiveness of the two advertisements. Assume that the respondent exposed to 'A' are dominant users of the product. Now suppose 50% of those who saw 'Advertisement A' bought the product and only 10% of those who saw 'Advertisement B' bought the product. From the above, one should not conclude that advertisement 'A' is more effective than advertisement 'B'. The main difference may be due to food preference habits between the groups, even in this case, internal validity might suffer but to a lesser degree.

6.3.6 Experimental Mortality

Some members may leave the original group and some new members join the old group. This is because some members might migrate to another geographical area. This change in the members will alter the composition of the group.

Example: Assume that a vacuum cleaner manufacturer wants to introduce a new version. He interviews hundred respondents who are currently using the older version. Let us assume that, these 100 respondents have rated the existing vacuum cleaner on a 10 point scale (1 for lowest and 10 for highest). Let the mean rating of the respondents be 7.

Now the newer version is demonstrated to the same hundred respondents and equipment is left with them for 2 months. At the end of two months only 80 participant respond, since the remaining 20 refused to answer. Now if the mean score of 80 respondents is 8 on the same 10 point scale. From this can we conclude that the new vacuum cleaner is better?

The answer to the above question depends on the composition of 20 respondents who dropped out. Suppose the 20 respondents who dropped out had negative reaction to the product, then the mean score would not have been 8. It may even be lower than 7. The difference in mean rating does not give true picture. It does not indicate that the new product is better than the old product.

One might wonder, why not we leave the 20 respondent from the original group and calculate the mean rating of the remaining 80 and compare. But this method also will not solve the mortality effect. Mortality effect will occur in an experiment irrespective of whether the human beings or involved or not.

6.4 CONCOMITANT VARIABLE

Concomitant variable is the extent to which a cause "X" and the effect "Y" Vary together in a predicted manner.

Example 1: Electrical car is new to India. People may or may not hold positive attitude about electrical cars. Assume that, the company has undertaken a new advertising campaign "To change the attitude of the people towards this car", so that the sale of this car can increase. Suppose, in testing the result of this campaign, the company finds that both aims have been achieved i.e., the attitude of the people towards electrical car has become positive and also the sales have increased. Then we can say that there is a concomitant variation between attitude and sales. Both variables move in the same direction.

Example 2: Assume that an education institute introduces a new elective which it claims is Job oriented. The college authorities advertise this course in leading news paper. They would like to know the perception of students to this course, and how many are willing to enroll. Now if on testing, it is found the perception towards this course is positive and majority of the respondent are willing to enroll, then we can say that, there is a concomitant variation between perception and enrolment. Both variables move in the same direction.

6.5 SYSTEMATIC APPROACH TO SOLVE A RESEARCH PROBLEM

Example: State transport authorities are seeking to understand: “Why is it the number of people travelling by particular bus route has declined suddenly?” The first step is exploratory research. It can be due to any one of the following reasons:

- Bad weather
- Fares have increased
- Frequency of the bus is poor
- Bus condition is bad
- Duration of the journey is more relative to other means of transport

First step: By process of elimination proceed as follows:

Check the weather records from meteorological department, for that period, when the occupancy declined. If no change, eliminate weather as the cause and so on.

Second step: Meet the commuters to know "the factor which they think is most important". If the passengers are not sensitive to fare or frequency, proceed to the next step. Step-2 Information can be collected by designing a small questionnaire.

Third step: is causal research. Under causal research, the researcher will find out "How one variable influences the other?" In this case, he can test, to find out, whether duration of the journey and the number of people traveling are related to each other.

6.6 EXPERIMENTAL DESIGNS

The various experimental designs are as follows:

- After only design
- Before - after design
- Factorial design
- Latin square design
- Expost facto design

6.6.1 After Only Design

In this design, dependent variable is measured, after exposing the test units to the experimental variable. This can be understood with the help of following example.

Assume M/s Hindustan Lever Ltd. wants to conduct an experiment on "Impact of free sample on the sale of toilet soaps". A small sample of toilet soap is mailed to a selected set of customers in a locality. After one month, 25 paise off on one cake of soap coupon is mailed to each of the customers to whom free sample has been sent earlier. An equal number of these coupons are also mailed, to people in another similar locality in the neighborhood. The coupons are coded, to keep an account of the number of coupons redeemed from each locality. Suppose, 400 coupons were redeemed from the experimental group and 250 coupons are redeemed from the control group. The difference of 150 is supposed to be the effect of the free samples. In this method conclusion can be drawn only after conducting the experiment.

6.6.2 Before-After Design

In this method, measurements are made before as well as after.

Example: Let us say that, an experiment is conducted to test an advertisement which is aimed at reducing the alcoholism.

Attitude and perception towards consuming liquor is measured before exposure to Ad. The group is exposed to an advertisement, which tells them the consequences, and attitude is again measured after several days. The difference, if any, shows the effectiveness of advertisement.

The above example of "Before-after" suffers from validity threat due to the following.

Before measure effect

It alerts the respondents to the fact that they are being studied. The respondents may discuss the topics with friends and relatives and change their behaviour.

Instrumentation effect

This can be due to two different instruments being used, one before and one after, change in the interviewers before and after, results in instrumentation effect.

6.6.3 Factorial Design

Factorial design permits the researcher to test two or more variables at the same time. Factorial design helps to determine the effect of each of the variables and also measure the interacting effect of the several variables.

Example: A departmental store wants to study the impact of price reduction for a product. Given that, there is also promotion (POP) being carried out in the stores (a) near the entrance (b) at usual place, at the same time. Now assume that there are two price levels namely regular price A1 and reduced price A2. Let there be three types of POP namely B1, B2, & B3. There are 3×2=6 combinations possible. The combinations possible are B1A1, B1A2, B2A1, B2A2, B3A1, B3A2. Which of these combinations is best suited is what the researcher is interested. Suppose there are 60 departmental stores of the chain divided into groups of 10 stores. Now, randomly assign the above combination to each of these 10 stores as follows:

Combinations	Sales
B_1A_1	S_1
B_1A_2	S_2
B_2A_1	S_3
B_2A_2	S_4
B_3A_1	S_5
B_3A_2	S_6

S_1 TO S_6 represents the sales resulting out of each variable. The data gathered will provide details on product sales on account of two independent variables.

The two questions that will be answered are.

Is the reduced price more effective than regular price?

Is the display at the entrance more effective than the display at usual location? Also the research will tell us about the interaction effect of the two variables.

Out come of the experiment on sales is as follows:

1. Price reduction with display at the entrance.
2. Price reduction with display at usual place.
3. No display and regular price applicable
4. Display at the entrance with regular price applicable.

6.6.4 Latin Square Design

Researcher chooses 3 shelf arrangements in three stores. He would like to observe the sales generated in each stores at different period. Researcher must make sure that one type of shelf arrangement is used in each store only once.

In Latin square design, only one variable is tested. As an example of Latin square design assume that a super market chain is interested in the effect of in store promotion on sales. Suppose there are 3 promotions considered as follows.

1 - No promotion

2 - Free sample with demonstration

3 - Window display

Which of the 3 will be effective? The out come may be affected by the size of the stores and the time period. If we choose 3 stores and 3 time periods, the total number of combination is $3 \times 3 = 9$. The arrangement is as follows

Time period	Store		
	1	2	3
1	B	C	A
2	C	A	B
3	A	B	C

Latin square is concerned with effectiveness of each kind of promotion on sales.

6.6.5 Expost Facto Design

This is a variation of "after only design". The groups such as experiment and control are identified only after they are exposed to the experiment.

Let us assume that a magazine publisher wants to know the impact of advertisement on knitting in 'Women's Era' magazine. The subscribers of magazines are asked whether they have seen this advertisement on "knitting". Those who have read and not read, are asked about the price, design etc. of the product. The difference indicates the effectiveness of advertisement. In this design, the experimental group is set to receive the treatment rather than exposing it to the treatment by its choice.

6.7 LET US SUM UP

This chapter deals with causal research design. Causal research is conducted mainly to prove the fact that one factor "X" the cause was responsible for the effect "Y". While conducting experiment, the researcher must guard against extraneous source of error. This may confound the experiment. Some of the extraneous factors, affecting the experiments are history, maturation, testing instrument, selection bias and experimental mortality concomitant variation refers to the extent to which variable X is related to variable "Y". Also it is to be understood that no one type of research can solve all the problems. All 3 type of research need to be put into use to solve the problem, in the order of exploratory, descriptive and causal. There are several experimental design such as Latin square design, Factorial design etc. each of which is used by the researcher under a particular circumstances. Latin square is appropriate when 2 extraneous factors are there, which causes distortion of results. Factorial design involves only one experimental variable.

Research design is affected by various types of errors such as sampling and non sampling error. At the end of the chapter, system approach to research design is diagrammatically shown.

6.8 LESSON END ACTIVITY

You are the manager of product planning and marketing research for a home appliances stores. Your company is considering a proposal to manufacture and market an emergency lamp in which segment the company currently does not have any product. You have assigned this project to one of your subordinates.

(i) Is this an exploratory, descriptive, or a causal study?

(ii) What data would be useful for deciding whether to develop an emergency lamp or not?

(iii) How will you design a study to obtain the needed data?

6.9 KEYWORDS

Causal research

Explanatory variable

Dependent variable

Independent variable

Extraneous variable

Maturation History

Selection Bias

Experiment Mortality

Concomitant variable

Expost facto design

Latin square design

Factorial design

Instrumentation effect

6.10 QUESTIONS FOR DISCUSSION

1. What is causal research? Give Example.
2. What is experimentation? Give Example.
3. What are Extraneous variables and Explanatory variables? Give Example.
4. What are Confounding and Concomitant variable. Give Example.
5. Explain briefly:
   (a) After only design
   (b) Before after design
   (c) Factorial design
   (d) Latin square design
6. What are the positive and negative aspects of a laboratory experiment?
7. What are the limitation of experimentation?
8. What is the difference between a laboratory experiment and field experiment?
9. What is a test unit give example?
10. Explain the advantages of experimental design.
11. What are the various extraneous variables which affect internal validity?
12. Explain each of the following with examples:
    (a) Maturation
    (b) History

(c) Instrument variation.

(d) Mortality

13. What is expost facto design. Explain with an example.
14. What type of research is used to solve the following problems:
    (a) Study on declining sales in a Geographical territory.
    (b) Study to choose location for establishing a shopping mall.
    (c) To estimate the demand for computer for the next 10 yrs.
15. Which type of research is used to solve which kind of market research problem?
16. What type of data collection would you recommend for each type of research?

6.11 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases",* All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision-making",* Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics",* D.B. Taraporevala Sons and Co. Private Limited, Bombay.

LESSON

7

CONCEPT OF MEASUREMENT

CONTENTS

7.0 AIMS AND OBJECTIVES

In this lesson we will study meaning, errors and techniques of measurement. After study this lesson you will be able to:

(i) understand meaning of and error in measurement.

(ii) construct sample questionnaire for attitude measurement.

(iii) know basic techniques of measurement.

7.1 INTRODUCTION

It is easy to measure quantitative data but difficult to do so if the data is qualitative or of abstract type. In case of measurement of attitude, the data belong to the abstract or qualitative type. To measure qualitative data or attitude we use scaling technique. To recruit a new incumbent and to evaluate human relations in factories, industries and different organizations, measurement of attitude in indispensable.

7.2 FEATURS OF A GOOD DESIGN

1. Various sources of obtaining the information is to be clear.
2. Should be clear with the availability of information and skills of the researcher.
3. Availability of time and money for the research work must be sufficient.

4. It should be flexible, appropriate, efficient and economical.
5. Design should help to obtain maximum information and to solve the research problem.

7.3 MEANING OF MEASUREMENT

Measurement is a process of mapping aspects of domain into other aspects of a range according to some rule of correspondence. Researcher may use different scales to measure the objects, scales differ from object to object, which are discussed earlier.

7.4 ERRORS IN MEASUREMENT

(a) ***Respondent:*** respondent may not be willing to share some sensitive information with the researcher. He may not be knowledgeable to answer the researcher's questions. These things may affects the measurement.

(b) ***Situation:*** situation factors may also affects the measurement. For example ladies may not be willing to share some personal matters in front of others.

(c) ***Measurer:*** errors may also creep in because of faulty analysis, tabulation, statistical calculation etc.

(d) ***Instrument:*** tools used for measurement is also a source of error, if it is not compatible to the data, researcher intend to collect.

7.5 TESTS OF SOUND MEASUREMENT

1. ***Validity:*** validity is the most critical criterion and indicates the degree to which an instrument measures what it is supposed to measure. Validity can also be thought of as utility.
2. ***Reliability:*** reliability means, measuring instrument should provide consistent results, even if it is measured repeatedly.
3. ***Practicality:*** measuring instrument must be economical and easy to use by the researcher. That means, researcher must be able to measure what he intends to measure.

7.6 TECHNIQUES OF MEASUREMENT

(a) concept development

(b) specification of concept dimension

(c) selection of indicators

(d) formation of index

First technique of measurement is to develop a concept, researcher intend to study. It means to arrive at an understanding about the topic to be measured. Second step is to specify the dimension of the topic, for instance if the study is on investor behavior, what type of investor is it retail investor or corporate investor etc. is to be specified. Third is to select what indicators to be studied in the specific dimension of the topic. Fourth is to form index.

7.7 SAMPLE QUESTIONNAIRE ITEMS FOR ATTITUDE MEASUREMENT

1. Do you think that expenditure on training is wasteful? (Give your answer selecting any one from the given alternatives).

   a. To a large extent

b. To some extent

c. To a very little extent

d. Not at all

2. What, to your knowledge, are the major barriers to effective implementation of flexible working hours in India? (Please arrange the factors in order of your perceived preference).

   a. Lack of awareness

   b. Difficulty in implementation

   c. Supervisory problems

   d. Lack of support from workers

   e. Lack of support from unions

   f. Production problems

   g. Any other (please specify)

The first questionnaire item (which reflects the attitude of a person regarding training) can be evaluated by adding the weighted value of individual response. How to give weight against questionnaire items has been explained in Scaling and Attitude Measurement part of this lesson.

Measurement can be made using nominal, ordinal, interval or ratio scale, details of which will be discussed in the next lesson.

Check Your Progress

A valid measurement is reliable, but a reliable measurement may not be valid. Give your own argument.

7.8 LET US SUM UP

Attitude measurement focuses on feelings and motives of the employees opinions about their working environments measurement is a process of mapping aspects of into other aspects of a range according to some rule of correspondence. There are mainly four sources of errors in measurement - respondent, situation, measure and instrument. Scaling techniques are used for measurement of attitude.

7.9 LESSON-END ACTIVITY

Give your opinion about the following statement: “Validity is more crucial than reliability.”

7.10 KEYWORDS

Attitude

Cognitive attitude

Affective attitude

Attitude measurement

Scaling techniques

7.11 QUESTIONS FOR DISCUSSION

1. What is attitude?
2. Discuss the various sources of attitude measurement.
3. List scales used in measurement.
4. What are the criteria for testing sound measurement?

7.12 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Cochran, William G., *Sampling Techniques,* New York: John Wiley & Sons.

Conway, Freda, *Sampling: An Introduction for Social Scientists,* London: George Allen and Unwin.

Deming, W.E., *Sample Design in Business Research,* New York: John Wiley & Sons.

Kaltan, Graham, *Introduction to Survey Sampling,* Beverly Hills, Calif: Sage.

Kish, Leslie, *Survey Sampling,* New York: John Wiley & Son.

Raj, Des, *The Design of Sample Surveys,* New York: McGraw-Hill.

Yates, Frank, *Sampling Methods for Censuses and Surveys,* New York: Hafner.

LESSON

8

SCALING TECHNIQUES

CONTENTS

8.0 AIMS AND OBJECTIVES

This lesson is intended to discuss different scaling techniques for measurement of attitude. After studying this lesson you would be able to:

(i) describe four widely accepted measurement scales.

(ii) construct various scales.

8.1 INTRODUCTION

In case of measurement of attitude, the data belongs to the abstract or qualitative type. There are four widely accepted levels of measurement called measurement scale'. These are: nominal, ordinal, interval and ratio scales.

From the view point of data, nominal scale to ratio scale, all the four scales are in increasing order of sophistication.

These measurement scales assist in designing survey methods for the purpose of collecting relevant data.

8.2 TYPES OF SCALE

(a) Nominal scale

(b) Ordinal scale

(c) Interval scale

(d) Ratio scale

8.2.1 Nominal Scale

In this scale, numbers are used to identify the objects. E.g. University Registration numbers assigned to students, numbers on jerseys, of sports personal.

Examples:

Have you ever visited Bangalore?

Yes-1

No-2

"Yes" is coded as "One" and "No" is coded as "Two". Numeric attached to the answers has no meaning, it is a mere identification. If numbers are interchanged as one for "No" and two for "Yes", it won't affect the answers given by the respondents. Numbers used in nominal scales serves only counting.

Telephone number is an example of nominal scale, where one number is assigned to one subscriber. The idea of using nominal scale is to make sure that no two persons or objects receive the same number. Bus route numbers are example of nominal scale.

"How old are you"? This is an example of nominal scale.

"What is your PAN Card No?

Arranging the books in the library, subjectwise, authorwise – we use nominal scale.

Example: Physics- 48, Chemistry – 92 etc.

Limitations:

(a) There is no rank ordering

(b) No mathematical operation is possible

(c) Statistical implication – Calculation of standard deviation and mean is not possible. It is possible to express mode.

8.2.2 Ordinal Scale (Ranking scale)

Ordinal scale is used for ranking in most market research studies. Ordinal scales are used to find consumer perception, preferences etc. E.g. Consumer may be given a list of brands which will suit and expect them to rank on the basis of ordinal scale.

- Lux
- Liril
- Cinthol
- Lifebuoy
- Hamam

Rank	Item	Number of respondents
I	Cinthol	150
II	Liril	300
III	Hamam	250
IV	Lux	200
V	Lifebuoy	100
Total		1,000

In the above example, II is mode and III is median.

Statistical implications: It is possible to calculate mode and median.

In market research, we often ask the respondents to rank say, "A soft drink, based upon flavour or colour". In such a case, ordinal scale is used. Ordinal scale is a ranking scale.

Rank the following attributes of 1 - 5 scale according to the importance in the microwave oven.

Attributes	Rank
A) Company image	5
B) Functions	3
C) Price	2
D) Comfort	1
E) Design	4

Difference between nominal and ordinal scales:

In nominal scale numbers can be interchanged, because it serves only for counting. Numbers in Ordinal scale has meaning and it won't allow interchangeability.

8.2.3 Interval Scale

Interval scale is more powerful than nominal and ordinal scale. The distance given on the scale represents equal distance on the property being measured. Interval scale may tell us "How far apart the objects are with respect to an attribute?" This means that, the difference can be compared. The difference between "1" and "2" is equal to the difference between "2" and "3".

Example 1: Suppose we want to measure the rating of a refrigerator using interval scale. It will appear as follows:

1.	Brand name	Poor ----------	Good
2.	Price	High ----------	Low
3.	Service after sales	Poor ----------	Good
4.	Utility	Poor ----------	Good

The researcher cannot conclude that the respondent who gives a rating of 6 is 3 times more favourable towards a product under study than another respondent who awards the rating of 2.

Example 2: How many Hours do you spend to do class assignment every day.

< 30 min.
30 min. to 1 hr.
1hr. to 1½ hrs.
> 1½ hrs.

Statistical implications: We can compute the range, mean, median etc.

Difference between interval and ordinal scales:

Ordinal scale gives only the ranking of the alternatives viz.., one is greater than the other, but it won't give the difference/distance between one and the other. Interval scales provide information about the difference between one and two.

8.2.4 Ratio Scale

Ratio scale is a special kind of internal scale that has a meaningful zero point. With this scale, length, weight, distance, can be measured. In this scale, it is possible to say, how many times greater or smaller one object compared to the other.

Example: sales of this year for product A is twice the sale of the same product last year.

Statistical implications: All statistical operation can be performed on this scale.

8.3 SCALE CONSTRUCTION TECHNIQUES

The following scales are measuring the attitude:

- Paired comparison
- Likert scale
- Semantic differential scale
- Thurstone scale

8.3.1 Paired Comparison

Example: Here a respondent is asked to show his preferences from among five brands of coffee - A, B, C, D and E with respect to flavors. He is required to indicate his preference in pairs. A number of pairs are calculated as flows. The brands to be rated is presented two at a time, so each brand in the category is compared once to every other brand. In each pair, respondents were asked to divide 100 points on the basis of how much they liked one compared to the other. The score is totaled for each brand.

$$\text{No. of pairs} = \frac{N(N-1)}{2}$$

$$\text{In this case, it is } \frac{5(5-1)}{2} = 10$$

A&B	B&D
A&C	B&E
A&D	C&D
A&E	C&E
B&C	D&E

If there are 15 brands to be evaluated, then we have 105 paired comparison and that is the limitation of this method.

8.3.2 Likert scale

It is called as summated rating scale. This consists of a series of statements concerning an attitude object. Each statement has " 5 points" Agree and Disagree on the scale, They are also called summated scales because scores of individual items are also summated to produce a total score for the respondent, likert scale consists of two parts - Item part and evaluation part. Item part is usually a statement about a certain product, event or attitude. Evaluation part is a list of responses like "Strongly agree", To " strongly disagree" The five points scale is used here. The numbers like +2, +1,0, -1,-2 are used. The likert scale must contain equal number of favorable and unfavorable statements, Now let us see with an example how attitude of a customer is measured with respect to a shopping mall.

Evaluation of Globus the Super Market by respondent

#	Likert scale items	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1	Salesman at shopping mall are courteous	-	-	-	-	-
2	Shopping mall does not has enough parking space	-	-	-	-	-
3	Prices of items are reasonable.	-	-	-	-	-
4	Mall has wide range of products, to choose	-	-	-	-	-
5	Mall operating hours are inconvenient	-	-	-	-	-
6	The arrangement of items in mall is confusing	-	-	-	-	-

The respondents overall attitude is measured by summing up his or her numerical rating on the statement making up the scale. Since some statements are favorable and others unfavourable, it is the one important task to be done before summing up the ratings. In other words, "Strongly agree" category attached to favourable statement and "strongly designed" category attached to unfavourable. The statement must always be assigned the same number, such as +2, or -2. The success of the likert scale depends on "How well the statements are generated?" Higher the respondent's score, the more favourable is the attitude. E.g. If there are two shopping mall, ABC and XYZ and if the scores using likert scale is 30 and 60 respectively, we can conclude that the customers attitude towards XYZ is more favourable than ABC.

8.3.3 Semantic Differential Scale

It is very similar to likert scale. It also consists of number of items to be rated by the respondents. The essential difference between likert and semantic differential scale is as follows:

It uses "Bipolar" adjectives and phrases. There are no statements in semantic differential scale.

Each pair of adjective is separated by Seven point scale.

Some individuals have favourable descriptions on the right side and some have on the left side. The reason for the reversal is to have a combination of both favourable and unfavourable statements.

Semantic differential scale items:

Please rate the five real estate developers mentioned below on the given scales for each of the five aspects. Developers are

1) Ansal 2) Raheja 3) Purvankara 4) Mantri 5) Salpuria

# Scale items	-3	-2	-1	0	+1	+2	+3	
1) Not reliable	_	_	_	_	_	_	_	Reliable
2) Expensive	_	_	_	_	_	_	_	Not expensive
3) Trustworthy	_	_	_	_	_	_	_	Not Trustworthy
4) Untimely delivery	_	_	_	_	_	_	_	Timely delivery
5) Strong Brand Image	_	_	_	_	_	_	_	Poor brand image

The respondents are asked to tick one of the seven categories which describes their views on the attitude. Computation is done exactly the same way as in likert scale. Suppose we are trying to evaluate the packaging of a particular product. The seven point scale will be as follows:

" I feel ……..

1. Delighted
2. Pleased
3. Mostly satisfied
4. Equally satisfied and dissatisfied
5. Mostly dissatisfied
6. Unhappy
7. Terrible

8.3.4 Thurstone Scale

This is also known as equal appearing interval scale. The following are the steps to construct thurstone scale:

Step 1: To generate a large number of statements, relating to the attitude to be measured.

Step 2: These statements (75 to 100) are given to a group of judges say 20 to 30 and asked to classify them according to the degree of favourableness and unfavourableness.

Step 3: 11 piles to be made by the judges. Piles vary from "most unfavourable" in pile number 1 to neutral in pile 6 and most favourable statement in pile 11.

Step 4: Study the frequency distribution of ratings for each statement and eliminate those statement, that different judges have given widely scattered ratings.

Step 5: Select one or two statements from each of the 11 piles for the final scale. List the selected statements in random order to form the scale.

Step 6: Respondents whose attitude are to be scaled are given the list of statements and asked to indicate agreement or disagreement with each statement. Some may agree with one statement and some may agree with more than one statement.

Example 1: Suppose we are interested in the attitude of certain socio economic class of respondents towards savings and investments. The final list of statement would be as follows:

1. One should live for the present and not the future. So savings are absolutely not required.
2. There are many attractions to spend the saved money.
3. It is better to spend savings than risk them in investments.
4. Investments are unsafe and also the money is blocked.
5. You earn to spend and not to invest.
6. It is not possible to save in these days.
7. Certain fixed amount of income should be saved and invested.
8. The future is uncertain and investments will protect us.
9. Some amount of savings and investments is a must for every earning of individual.
10. One should try to save more so that most of it can be invested.
11. All the savings should be invested for the future.

Conclusion: A respondent agreeing to statement 8,9,11 would be considered to have a favourable attitude towards savings and investments. The person agreeing with the statements 2,3 & 4 will be having an unfavourable attitude. Also, if a respondents chooses 1,3,7,9 his attitude is not considered as organized.

Merits of Thurstone Scale:

1. Very reliable, if we are measuring a single attitude
2. Used to find attitude towards issues like war, religion, language, culture, place of worship etc.

Limitations:

1. Limited use in MR, since it is time consuming
2. Number of statement collection (100-200) is very tedious
3. Judges bias may be there
4. This method is expensive

8.4 LET US SUM UP

Chapter deals with scales used to measure attitude. Measurement can be made using nominal, ordinal, interval or ratio scale. These scales show the extent of likes / dislikes, agreement / disagreement or belief towards an object. Each of the scale has certain statistical implications. There are four types of scales used in market research namely paired comparison, Likert, semantic differential and thurstone scale. Likert is a five point scale whereas semantic differential scale is a seven point scale. Bipolar adjectives are used in semantic differential scale. Thurstone scale is used to assess attitude of the respondents group regarding any issue of public interest MDS uses perceptional map to evaluate customers attitudes. The attribute or non attribute method could be used.

Last part of the chapter deals with criteria that is used to decide whether the scale chosen is good or not. Validity and reliability of the scale is verified before the scale is used for measurement. If repeated measurement gives the same result, then the scale said to be reliable. Validity refers to "Does the scale measure what it intends to measure". There are 3 methods to check the validity which type of validity is required depends on "What is being measured".

8.5 LESSON END ACTIVITY

A manufacturer of packed bakery items wants to evaluate customer attitudes toward his product brand. 300 customers who buy this brand filled the questionnaire that was sent to them. The answers of this questionnaire were converted to scale and the results are as follows:

(a) The average score from the above sample on a 10-item *Likert Scale* was 65

(b) Average score for a sample on 10-item Semantic *Differential Scale* was 60.

You are required to indicate whether these customers had a favourable or unfavourable attitude towards the products.

8.6 KEYWORDS

Nominal scale

Ordinal scale

Interval scale

Ratio scale

Paired comparison

Likert scale, Bipolar adjective

Thustone scale

Semantic differential

Non-attribute method

Attribute method

Reliability

Construct validity

Content validity

Predictive validity

Internal validity

8.7 QUESTIONS FOR DISCUSSION

1. What are the 4 types of scales used to measure attitude?
2. What is a paired comparison scale?
3. What are the statistical implication of various scales?
4. What is forced and unforced scale?
5. What is attribute and non-attribute method in scaling?
6. What are the different types, sources and characteristics of hypothesis?

8.8 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Cochran, William G., *Sampling Techniques,* New York: John Wiley & Sons.

Conway, Freda, *Sampling: An Introduction for Social Scientists,* London: George Allen and Unwin.

Deming, W.E., *Sample Design in Business Research,* New York: John Wiley & Sons.

Kaltan, Graham, *Introduction to Survey Sampling,* Beverly Hills, Calif: Sage.

Kish, Leslie, *Survey Sampling,* New York: John Wiley & Son.

Raj, Des, *The Design of Sample Surveys,* New York: McGraw-Hill.

Yates, Frank, *Sampling Methods for Censuses and Surveys,* New York: Hafner.

UNIT-III

LESSON

9

SAMPLING DESIGN

CONTENTS

9.0 AIMS AND OBJECTIVES

In this lesson we will study meaning, criteria and types of sampling design. Here we will discuss the probability and non-probability techniques of sampling. After studying this lesson you will be able to:

(i) define sampling.

(ii) describe steps involved in the sampling process.

(iii) distinguish between different types of sampling design.

(iv) describe various probability and non-probability sampling techniques.

9.1 INTRODUCTION

The most important task in carrying out a survey is to select the sample. Sample selection is undertaken for practical impossibility to survey the population. By applying rationality in selection of samples, we generalise the findings of our research. There are different types of sampling, which are studied in this lesson.

9.2 MEANING AND CONCEPTS OF SAMPLE

A sample is a part of target population, which is carefully selected to represent the population.

9.2.1 Sample Frame

Sampling frame is the list of elements from which the sample is actually drawn. Actually sampling frame is nothing but correct list of population. Example: Telephone directory, Product finder, Yellow pages.

9.2.2 Distinction between Census and Sampling

Census refers to complete inclusion of all elements in the population. Sample is a subgroup of the population.

When is a census appropriate?

1. Census is appropriate if population size is small. For Example: A researcher may be interested in contacting firms in iron and steel or petroleum product industry these industries are limited in number so census will be suitable.
2. Sometimes the researcher is interested in gathering information from every individual. Example: Quality of food served in a mess.

When is sample appropriate?

1. When the population size is large
2. When time and cost is the main consideration in research
3. If the population is Homogeneous
4. Also there are circumstances when census is impossible. Example: Reaction to global advertising by a company.

9.3 STEPS IN SAMPLING

Sampling process consists of seven steps. They are:

1. Define the population
2. Identify the sampling frame
3. Specify the sampling unit
4. Selection of sampling method
5. Determination of sample size
6. Specify sampling plan
7. Selection of sample

(1) ***Define the population:*** Population is defined in terms of

(a) Elements
(b) Sampling units
(c) Extent
(d) Time.

Example: If we are monitoring the sale of a new product recently introduced by a company, say (shampoo sachet) the population will be

(a) Element - Company's product
(b) Sampling unit - Retail outlet, supermarket
(c) Extent - Hyderabad and Secundrabad
(d) Time - April 10th to May 10th, 2006

(2) ***Identify the sampling frame:*** Sampling frame could be (a) Telephone Directory (b) Localities of a city using corporation listing (c) Any other list consisting of all sampling units.

Example: You want to study about scooter owners in a city. RTO will be the frame, which provides you name, address and the type of vehicle possessed.

(3) ***Specify sampling unit:*** Who is to be contacted- they are the sampling units. If retailers is to be contacted in a locality, that is the sampling unit.

Sampling unit may be husband or wife in a family. Selection of sampling unit is very important. If interviews are to be held during office timings, when the head of families and other employed persons are away , interviewing would under represent employed persons, and over represent elderly persons, housewives and the unemployed.

(4) ***Selection of sampling method:*** This refers to whether (a) probability or (b) Non-probability methods are used.

(5) ***Determination of sample size:*** This means, we need to decide " How many elements of the target population is to be chosen?" Sample size depends upon the type of study that is being conducted. For Example: If it is an exploratory research, the sample size will be generally small. For conclusive research such as descriptive research, sample size will be large.

Sample size also depends upon the resources available with the company. Sample size depends on the accuracy required in the study and the permissible error allowed.

(6) ***Specify sampling plan:*** Sampling plan should clearly specify the target population. Improper defining would lead to wrong data collection.

Example: This means that, if survey of household is to be conducted, a sampling plan should define a "Household" i.e., " Is it husband or wife or both" minor etc., "Who should be included or excluded". Instruction to the interviewer should include "How he should take systematic sample of households, probability sampling /non – probability sampling". Advise him on what he should do, when no one is available on his visit, to the household.

(7) ***Selection of sample:*** This is the final step in sampling process.

9.4 CRITERIA FOR GOOD SAMPLE

Sampling strategy has two main components:

- Selecting the sample, which involves sampling
- Processing the data which has certain rules for calculating statistics.

Good sampling design should take into account both of these and should

- Relate to the objectives of the investigation
- Be practical and achievable;
- Be cost–effective in terms of equipment and labour;
- Provide estimates of population parameters that are truly representative and unbiased.

Ideally, representative samples should be:

- Taken at random so that every member of the population of data has an equal chance of selection;
- Large enough to give sufficient precision;
- Unbiased by the sampling procedure or equipment.

These may well conflict and there is rarely any unique best answer to a sampling problem.

It is very important in sampling procedures to take into account relevant factors such as:

- location
- habitat

- time
- age
- sex
- physiological condition and
- disease status

These also need to be noted in the design as otherwise a wrong interpretation may arise from the results.

9.5 TYPES OF SAMPLE DESIGN

Sampling is divided into two types:

Probability sampling: In probability sample, every unit in the population has equal chances for being selected as a sample unit.

Non–probability sampling: In non probability sampling, units in the population has unequal or zero chances for being selected as a sample unit.

9.5.1 Probability Sampling Techniques

1. Random sampling
2. Systematic sampling
3. Stratified random sampling
4. Cluster sampling
5. Multistage sampling

Random sampling

Simple random sample is a process in which every item of the population has equal probability of being chosen.

There are two methods used in random sampling –

(1) Lottery method

(2) Using random number table.

(1) ***Lottery method:*** Take a population containing 4 departmental stores: A, B, C & D. Suppose we need to pick a sample of two store from the population using simple random procedure. We write down all possible sample of two. Six different combination each containing two stores from the population. Combination are AB, AD, AC, BC BD, CD. We can now write down 6 sample combination on six identical pieces of paper, fold the piece of paper so that they cannot be distinguished. Put them in a box. Mix it and pull one at random. This procedure is the lottery method of making random selection.

(2) ***Using Random number table:*** A Random number table consists of a group of digits that are arranged in random order, i.e. any row, column, or diagonal in such a table contains digits that are not in any systematic order. There are 3 tables for random numbers (a) Tippet's table (b) Fisher and Yate's table (c) Kendall and Raington table.

Table for random number is as follows:

40743	39672
80833	18496
10743	39431

88103	23016
53946	43761
31230	41212
24323	18054

Example: Taking the earlier example of stores we first number the stores.

1 A 2 B 3 C 4 D

The stores A, B, C, D has been numbered as 1,2,3,4.

In order to select 2 shops out of 4 randomly, we proceed as follows:

Suppose we start with second row in the first column of the table and decide to read diagonally. The starting digit is 8. There is no departmental stores with number 8 in the population. There are only 4 stores. Move to the next digit on the diagonal, which is 0. Ignore it since it does not correspond to any stores in the population. The next digit on the diagonal is 1 which corresponds to store A. Pick A and proceed until we get 2 samples. In this case the 2 departmental stores are 1 and 4. Sample derived from this consists of departmental stores A and D.

In random sampling there are 2 possibilities (1) Equal probability (2) Varying probability.

Equal probability

This is also called as random sampling with replacement.

Example: Put 100 chits in a box numbered 1 to 100. Pick one No. at random. Now the population has 99 chits. Now, when a Second number is picked, there are 99 chits. In order to provide equal probability, the sample selected is replaced in the population.

Varying probability

This is also called random sampling without replacement. Once a number is picked, it is not included again. Therefore the probability of selecting a unit varies from the other. In our example it is 1/100, 1/99, 1/98, 1/97 if we select 4 samples out of 100.

Systematic random sampling

There are 3 steps:

(1) Sampling interval K is determined

$$K = \frac{\text{No. of units in the population}}{\text{No. of units desired in the sample}}$$

(2) One unit between the first and Kth unit in the population list is randomly chosen.

(3) Add Kth unit to the randomly chosen number.

Example: Consider 1000 households, from which we want to select 50 units.

$$\text{Calculate } K = \frac{1000}{50} = 20$$

To select the first unit, we randomly pick one number between 1 to 20 say 17. So our sample is starting with 17, 37, 57…….. Please note that only first item was randomly selected. The rest are systematically selected. This is a very popular method because, we need only one random number.

Stratified random sampling

A probability sampling procedure in which simple random sub-samples are drawn from within different strata that are more or less equal on some characteristics. Stratified sampling are of two types

1. ***Proportionate stratified sampling:*** The number of sampling units drawn from each stratum is in proportion to the population size of that stratum.
2. ***Disproportionate stratified sampling:*** The number of sampling units drawn from each stratum is based on the analytical consideration, but not in proportion to the population size of that stratum.

Sampling process is as follows

1. The population to be sampled is divided into groups (stratified)
2. A simple random sample is chosen

Reason for stratified sampling

Sometimes marketing professionals want information about the component part of the population. Assume there are 3 stores. Each store forms a strata and sampling from within each strata is selected. The result might be used to plan different promotional activities for each store strata.

Suppose a researcher wishes to study the retail sale of product such as tea in a universe of 1000 grocery stores (Kirana shops included). The researcher will first divide this universe into say 3 strata based on store size. This bench mark for size could be only one of the following (a) Floor space (b) Sales volume (c) Variety displayed etc.

Stores size	**No. of stores**	**Percentage of stores**
Large stores	2000	20
Medium stores	3000	30
Small stores	5000	50
Total	**10,000**	**100**

Suppose we need 12 stores, then choose 4 from each strata. Choose 4 stores at random. If there was no stratification, simple random sampling from the population would be expected to choose 2 large stores (20 percent of 12) about 4 medium stores (30 percent of 12) and about 6 small stores (50 percent of 12).

As can be seen, each store can be studied separately using stratified sample.

Stratified sampling can be carried out with

1. Same proportion across strata called proportionate stratified sample
2. Varying proportion across strata called disproportionate stratified sample.

Example:

Stores size	**No. of stores (Population)**	**Sample Proportionate**	**Sample Disproportionate**
Large	2000	20	25
Medium	3000	30	35
Small	5000	50	40
Total	**10,000**	**100**	**100**

Estimation of universe mean with a stratified sample

Example:

Stores size	**Sample Mean Sales per store**	**No. of stores**	**Percent of stores**
Large	200	2000	20
Medium	80	3000	30
Small	40	5000	50
Total		**10,000**	**100**

The population mean of monthly sales is calculated by multiplying the sample mean by its relative weight.

$200 \times 0.2 + 80 \times 0.3 + 40 \times 0.5 = 84$

Sample proportionate

If N is the size of the population.

n is the size of the strain.

i represents 1,2,3,……..k [number of strata in the population]

$\therefore$ Proportionate sampling

$$P = \frac{n_1}{N_1} = \frac{n_2}{N_2} = \text{.....} = \frac{n_k}{N_k} = \frac{n}{N}$$

$$\frac{n_1}{N_1} = \frac{n}{N}$$

$$n_1 = \frac{n}{N} \times n_1$$ and so on

n_1 is the sample size to be drawn from stratum 1

$n_1 + n_2 + \ldots\ldots\ldots\ldots n_k = n$ [Total sample size of the all strata]

Illustration: A survey is planned to analyse the perception of people towards their own religious practices. Population consists of various religious, viz, Hindu, Muslim, Christian, Sikh, Jain assume total population is 10000. Hindu, Muslim, Christian, Sikh and Jains consists of 6000, 2000, 1000, 500 and 500 respectively. Determine the sample size of each stratum by applying proportionate stratified sampling. If the sample size required is 200.

Solution: Total population, N=10000

Population in the strata of Hindus N_1=6000

Population in the strata of Muslims N_2=2000

Population in the strata of Christians N_3=1000

Population in the strata of Sikhs N_4=500

Population in the strata of Jains N_5=500

Proportionate stratified sampling

$$P = \frac{n_1}{N_1} = \frac{n_2}{N_2} = \frac{n_3}{N_3} = \frac{n_4}{N_4} = \frac{n_5}{N_5} = \frac{n}{N}$$

$\therefore$ Let us determine the sample size of strata N_1

$$\frac{n_1}{N_1} = \frac{n}{N} \times N_1 = \frac{200}{10000} \times 6000$$

$$= 20 \times 6$$

$$= 120.$$

$$n_2 = \frac{n}{N} \times N_2 = \frac{200}{10000} \times 2000$$

$$= 40.$$

$$n_3 = \frac{n}{N} \times N_3 = \frac{200}{10000} \times 1000$$

$$= 20$$

$$n_4 = \frac{n}{N} \times N_4 = \frac{200}{10000} \times 500$$
$$= 10$$

$$n_5 = \frac{n}{N} \times N_5 = \frac{200}{10000} \times 500 = 10$$

$$n = n_1 + n_2 + n_3 + n_4 + n_5$$
$$= 120+40+20+10+10$$
$$= 200.$$

Sample Disproportion:

Let σi is the variance of the stratum i,

where i = 1,2,3…….k.

Formula to compute the sample size of the stratum i is.

is the variance of the stratum i,

where size of stratum i

ri = Sample size of stratum i

ri = Ratio of the size of he stratum I with that of the population.
Ni = Population of stratum i
N = Total population.

Illustration: Govt. of India wants to study the performance of women self help groups (WSHG) in three region viz. North, South and west. Total WSHG's are 1500. Number of groups in North, South and West are 600, 500 and 400 respectively. Govt. found more variation between WSHG's in North, South and West regions. The variance of performance of WSHG's in there regions are 64, 25 and 16 respectively. If the disappropriate stratified sampling is to be sued with the sample size of 100, determine the number of sampling units for each regions.

Solutions

Total Population N = 1500

Size of the stratum 1, N_1 = 600

Size of the stratum 2, N_2 = 500

Size of the stratum 3, N_3 = 400

Variance of stratum 1, $\sigma 1^2$ = 64
Variance of stratum 2, $\sigma 2^2$ = 25
Variance of stratum 3, $\sigma 3^2$ = 16

Sample size n = 100

Stratum Number	Size of the stratum N_i	$ri = \frac{N_i}{N}$	σi	$ri\sigma in$	$ri\sigma in = \frac{ri\sigma in}{\sum_1^3 ri\sigma i}$
1	600	0.4	8	3.2	54
2	500	0.33	5	1.65	28
3	400	0.26	4	1.04	18
Total					100

Cluster sampling

Following steps are followed.

1. Population is divided into clusters
2. A simple random sample of few clusters selected

3. All the units in the selected cluster is studied.

Step - 1: Mentioned above of cluster sampling is similar to the first step of stratified random sampling. But the 2 sampling methods are different. The key to cluster sampling is decided by how homogeneous or heterogeneous the clusters are.

Major advantage of simple cluster sampling is the case of sample selection. Suppose we have a population of 20,000 units from which we want to select 500 units. Choosing a sample of that size is a very time consuming process, if we use Random Numbers table. Suppose the entire population is divided into 80 clusters of 250 units, we can choose two sample clusters (2x250=500) easily by using cluster sampling. The most difficult job is to form clusters. In marketing the researcher forms clusters so that he can deal each cluster differently.

Example:

Assume there are 20 household in a locality

Cross	Houses			
1	X_1	X_2	X_3	X_4
2	X_5	X_6	X_7	X_8
3	X_9	X_{10}	X_{11}	X_{12}
4	X_{13}	X_{14}	X_{15}	X_{16}

We need to select 8 houses. We can choose 8 houses at random. Alternatively, 2 clusters each containing 4 houses can be chosen. In this method, every possible sample of eight houses would have a known probability of being chosen - i.e. chance of one in two. We must remember that in the cluster each house has the same characteristics. With cluster sampling, it is impossible for certain random sample to be selected. For example, in the cluster sampling process described above, the following combination of houses could not occur: X_1 X_2 X_5 X_6 X_9 X_{10} X_{13} X_{14}. This is because the original universe of 16 houses have been redefined as a universe of 4 clusters. So only clusters can be chosen as sample.

Multistage sampling

The name implies that sampling is done in several stages. This is used with stratified / cluster designs.

An illustration of double sampling is as follows.

Management of newly opened club is soliciting for membership. Therefore during first round all corporates are sent details so that those who are interested may enroll. Having enrolled, the second round concentrates on, how many are interested to enroll for various entertainment activities that club is offering such as Billiards club, indoor sports, swimming, and gym etc. After getting this information, you might stratify the interested respondents. This also will tell you the reaction of new members to various activities. This technique is considered to be scientific, since there is no chance of ignoring the characteristics of the universe.

Advantage: May reduce cost, if first stage results is enough to stratify or cluster.

Disadvantage: Increases the cost as more and more stages are included.

Area sampling

This is a Probability sampling. This is a special from of cluster sampling

Example 1: If someone wants to measure toffee sale in retail stores, one might choose a city locality and then audit toffee sales, in all retail outlets in those localities.

The main problem in area sampling is the non-availability of shop list selling toffee in a particular area. Therefore, it would be impossible to choose a probability sample from these outlets directly. Therefore, the first job is to choose a geographical area and then

list out all outlets selling toffee. Then follow probability sample for shops among the list prepared.

Example 2: You may like to choose shops which sells Cadbury dairy milk. The disadvantage of area sampling is that it is expensive and time consuming.

What are the Advantages v/s Disadvantages of probability Sampling?

The advantages of probability Sampling are that:

- It is unbiased.
- Quantification is possible in probability sampling.
- Less knowledge of universe is sufficient.

The disadvantages of probability sampling are that:

- It takes time.
- It is costly
- More resources are required to design and execute than non-probability design. In M.R, due to time and budget constraints, non-probability sample is used.

Check Your Progress

1. What is a sample?
2. Describe the criteria for good sample.
3. What are the different steps in systemic random sampling?

9.5.2 Non-Probability Sampling Techniques

1. Deliberate sampling
2. Shopping Mall Intercept Sampling
3. Sequential sampling
4. Quota sampling
5. Snowball sampling
6. Panel samples

Deliberate or Purposive Sampling

This is also called judgment sampling. The investigator uses, his discretion in selecting sample observations from the universe. As a result, there is an element of bias in the selection. From the point of the investigator, the sample thus chosen may be a true representative of the universe. However , the units in the universe do not enjoy equal chance of getting included in the sample. Therefore, it cannot be considered as a probability sampling.

Example: Test market cities are selected based on judgment sampling, because these cities are viewed as a typical cities matches certain demographical characteristics.

Shopping Mall Intercept Sampling

This is a non-probability sampling method. In this method, respondents are recruited for individual interviews at fixed locations in shopping malls. (Example: Shopper's Shoppe, Food World, Sunday to Monday) This type of study would include several malls, each serving different socio-economic population.

Example: The researcher may wish to compare responses of two or more TV commercials for two or more products. Mall samples can be informative for this kind of

studies. Mall samples should not be used under following circumstances i.e., If the difference in effectiveness of two commercials varies with the frequency of mall shopping, change in the demographic characteristic of mall shoppers, or any other characteristic. The success of this method depends on "How well the sample is chosen".

Merits

1. It has relatively small universe.
2. In most cases, it is expected to give quick results. The purpose of deliberate sampling has become a practical method in dealing with economic or practical problems.
3. In studies, where the level of accuracy can vary from the prescribed norms, this method can be used.

Demerits

1. Fundamentally, this is not considered a scientific approach, as it allows for bias.
2. The investigator may start with a preconceived idea and draw samples such that the units selected will be subjected to specific judgment of the enumerator.

Sequential Sampling

This is a method in which sample is formed on the basis of a series of successive decisions. They aim at answering the research question on the basis of accumulated evidence. Sometimes, a researcher may want to take a modest sample, look at the results. Thereafter decide if more information is required for which larger samples are considered. If the evidence is not conclusive, after a small sample is taken, more samples are required. If still inconclusive still larger samples are taken. At each stage a decision is made about whether more information should be collected or the evidence is now sufficient to permit a conclusion.

Example: Assume that a product need to be evaluated.

A small probability sample is taken from among the current user. Suppose it is found that average annual usage is between 200 to 300 units and it is known that product is economically viable only if the average consumption is 400 units. This information is sufficient to take a decision to drop the product. On the other hand if initial sample shows a consumption level of 450 to 600, additional samples are needed for further study.

Quota Sampling

Quota sampling is quite frequently used in marketing research. It involves the fixation of certain quotas, which are to be fulfilled by the interviewers.

Suppose 2,00,000 students are appeared for a competitive examination and we need to select 1% of them based on quota sampling. The classification of quota may be as follows.

Example of quota sampling

Classification of samples

Category	Quota
General merit	1000
Sport	600
NRI	100
SC/ST	300
TOTAL	2000

Quota sampling involves following steps:

1. The population is divided into segments on the basis of certain characteristics. Here segments are called cells.
2. A quota of unit is selected from each cell.

Advantages of quota sampling

1. Quota sampling does not require prior knowledge about the cell to which each population unit belongs. Therefore this sampling has a distinct advantage over stratified random sampling, where every population unit must be placed in the appropriate stratum before the actual sample selection.
2. It is simple to administer. Sampling can be done very fast.
3. Researcher going to various Geographical locations is avoided and therefore cost is reduced.

Limitations of quota sampling

1. It may not be possible to get a "representative" sample within the quota as the selection depends entirely on the mood and convenience of the interviewers.
2. Since too much liberty is given to the interviewers, the quality of work suffers if they are not competent.

Snowball sampling

This is a non-probability sampling. In this method, the initial group of respondents are selected randomly. Subsequent respondents are selected based on the opinion or referrals provided by the initial respondents. Further, referrals will lead referrals thus, leading to a snowball sampling. The referrals will have a demographic and psychographic characteristics that are relatively similar to the person referring them.

Example: College students bring in more college students on the consumption of pepsi. The major advantage of snowball sampling is that it monitors the desired characteristics in the population.

Panel samples

Panel samples are frequently used in marketing research. To give an example, suppose that ,one is interested in knowing the change in the consumption pattern of households. A sample of households are drawn. These households are contacted to gather information on the pattern of consumption, subsequently, say after a period of six months, the same households are approached once again and the necessary information on their consumption is collected.

9.6 DISTINCTION BETWEEN PROBABILITY SAMPLE AND NON-PROBABILITY SAMPLE

9.6.1 Probability Sample

1. Here each member of a universe has a known chance of being selected and included in the sample
2. Personal bias is avoided. The researcher cannot exercise, his discretion in the selection of sample items

Examples: Random Sample, cluster sample.

9.6.2 Non-Probability Sample

In this case, the chance of choosing a particular universe element is unknown. The sample chosen in this method is based on aspects like convenience, quota etc.

Examples: - Quota sampling, judgment sampling

Illustration 1: Determine the sample size if standard deviation of the population is 3.9, population mean is 36 and sample mean is 33 and the desired degree of precision is 99 per cent.

Solution:

Given $\sigma = 3.9,\ \mu = 36, \bar{x} = 33$

and z = 1% (99% precision implies 1% level of significance)

i.e. z_α = 2.576 (at 1% l.o.s)

(Table value)

We know that, sample size n can be obtained using the relation.

$$n = \left(\frac{z_\alpha \sigma}{d}\right)^2 \text{ where } d = \mu - \bar{x}$$

$$\Rightarrow n = \left(\frac{2.576 X 3.9}{36 - 33}\right)^2 = 11.21;11$$

Illustration 2: Determine the sample size if standard deviation of the population is 12 and standard error (standard deviation of the sampling distribution) is 3.69.

Solution:

Given Standard deviation of population

$$\sigma = 12$$

Standard error = $\sigma x = 3.69$

We know that

$$\sigma x = \frac{\sigma}{\sqrt{n}}$$

$$\Rightarrow \quad \sigma x^2 = \frac{\sigma^2}{n}$$

$$\Rightarrow \quad n = \frac{\sigma^2}{\sigma x^2} = \left(\frac{12}{3.69}\right)^2$$

$$n = 10.57 \simeq 11$$

Illustration 3: Determine the sample size, if sample proportion p = 0.4 & standard error of proportion is 0.043

Solution:

Given that $p = 0.4 \Rightarrow q = 0.6\ \sigma_p = 0.043$

We know that $\Rightarrow \sigma p^2 = \sqrt{\frac{pq}{n}}$

$$\Rightarrow \quad \sigma p^2 = \frac{pq}{n}$$

$$\Rightarrow \quad n = \frac{pq}{\sigma p^2} = \frac{0.4 \times 0.6}{(0.043)^2}$$

= 129.79 $\simeq$ 130

Illustration 4: Determine the sample size if standard deviation of the population is 8.66, sample mean is 45, population mean 43 and the desired degree of precision is 95%.

Solution:

Given that $\mu = 43,\ \overline{X} = 45$

$\sigma = 8.66$ z = 5% l.o.s

$\Rightarrow \quad z_\alpha = 1.96$

We know that, sample size n can be obtained using the relation

$$n = \left(\frac{z_\alpha \sigma}{d} \right)^2 \text{ where } d = \mu - \bar{x}$$

$$\simeq \text{n} = \left(\frac{1.96 \times 8.66}{43 - 45} \right)^2 = 72.03 \simeq 72$$

9.7 LET US SUM UP

Sample is a representative of population. Census represents cent percent of population. The most important factors distinguishing whether to choose sample or census is cost and time. There are seven steps involved in selecting the sample. There are 2 types of sample (a) Probability sampling (b) Non probability sample. Probability sampling includes random sampling, stratified random sampling systematic sampling, cluster sampling, Multistage sampling. Random sampling can be chosen by Lottery method or using random number table. Samples can be chosen either with equal probability or varying probability. Random sampling can be systematic or stratified. In systematic random sampling, only the first number is randomly selected. Then by adding a constant "K" remaining numbers are generated. In stratified sampling, random samples are drawn from several strata, which has more or less same characteristics. In multistage sampling, sampling is drawn in several stages.

9.8 LESSON END ACTIVITY

Prepare a sample plan including the sample size for a bathing soap, keeping in mind both the male and female customers. Use three economic strata, the educational level, per capita income and the age group influencing the buyer behaviour. Prepare a sampling design for the following:

(i) To measure the effectiveness for a TV Ad on soaps

(ii) To assess the market share of a branded soap.

9.9 KEYWORDS

Sample frame
Census
Random sampling
Stratified random sampling
Systematic sampling
Cluster sampling
Multistage sampling
Quota sampling
Snow to all sampling
Deliberate sampling
Panel sampling

9.10 QUESTIONS FOR DISCUSSION

1. Distinguish between census and sampling.
2. What are the steps involved in the process of sampling?
3. What are the different types of sample designs?
4. What are the types of probability sampling techniques?
5. Explain the following:
   (a) Process of stratified sampling
   (b) Reasons for stratified sampling
6. What are the steps to be followed in the process of cluster sampling?
7. What are the advantages and disadvantages of multistage sampling?
8. Discuss the advantages and disadvantages of probability sampling technique?
9. What is non-probability sampling technique?
10. What are the types of non-probability sampling techniques?
11. What are the merits and demerits of shopping mall intercept sampling?
12. What are the advantages and limitations of quota sampling?
13. Distinguish probability and non probability sampling.
14. What are the guidelines to determine the sample size of a population?

9.11 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods*, Excel Books, 2007.

Cochran, William G., *Sampling Techniques*, New York: John Wiley & Sons.

Conway, Freda, *Sampling: An Introduction for Social Scientists*, London: George Allen and Unwin.

Deming, W.E., *Sample Design in Business Research*, New York: John Wiley & Sons.

Kaltan, Graham, *Introduction to Survey Sampling*, Beverly Hills, Calif: Sage.

Kish, Leslie, *Survey Sampling*, New York: John Wiley & Son.

Raj, Des, *The Design of Sample Surveys*, New York: McGraw-Hill.

Yates, Frank, *Sampling Methods for Censuses and Surveys*, New York: Hafner.

LESSON
10

DATA COLLECTION

CONTENTS

10.0 AIMS AND OBJECTIVES

In this lesson we will study types and sources of data collection. Here we will also discuss the tools of data collection and method for designing questionnaire. After studying this lesson you will be able to:

(i) distinguish between primary and secondary data.

(ii) understand data collection procedure

(iii) describe types of syndicated data

(iv) design questionnaire

10.1 INTRODUCTION

Once the researcher has decided the 'Research Design' the next job is of data collection. For data to be useful, our observations need to be organized so that we can get some patterns and come to logical conclusions.

Statistical investigation requires systematic collection of data, so that all relevant groups are represented in the data.

Depending upon the sources utilized, whether the data has come from actual observations or from records that are kept for normal purposes, statistical data can be classified into two categories-primary and secondary data.

10.2 TYPES OF DATA-SOURCES

10.2.1 Primary Data

Data directly collected by the researcher, with respect to problem under study, is known as primary data. Primary data is also the first hand data collected by the researcher for the immediate purpose of the study.

10.2.2 Secondary Data

Secondary data are statistics that already exists. They have been gathered not for immediate use. This may be described as "Those data that have been compiled by some agency other than the user". Secondary data can be classified as:

- Internal secondary data
- External secondary data

10.2.3 Internal Secondary Data

Is that data which is a part of company's record, for which research is already conducted. Internal data are those, which are found within the organisation. Example: Sales in units, credit outstanding, sales persons call reports, daily production report, monthly collection report, etc.

10.2.4 External Secondary Data

The data collected by the researcher from outside the company. This can be divided into four parts:

- Census data
- Individual project report published
- Data collected for sale on a commercial basis called syndicated data
- Miscellaneous data
- ***Census data:*** is the most important among the sources of data. The following are some of the data that can got by census–
- Census of the wholesale trade
- Census of the retail trade

- Population census
- Census of manufacturing industries
- Individual project report publicized
- Encyclopedia of business information sources
- Product finder
- Thomas registers etc.

10.2.5 Special Techniques of Market Research or Syndicated Data

These techniques involve data collection on a commercial basis i.e., Data collected by this method is sold to interested clients, on payment. Example of such organisation is Neilson Retail, ORG Marg, IMRB etc. These organizations provide NRS called National Readership Survey to the sponsors and advertising agencies. They also provide business relationship survey called BRS which estimates the following:

(a) Rating

(b) Profile of the company etc.

(c) These people also provide TRP rating namely television rating points on a regular basis. This provides

(i) Viewership figures

(ii) Duplication between programmes etc. Some of the interesting studies made by IMRB are SNAP- Study of Nations Attitude and Awareness Programme. In this study, the various groups of the Indian population and their life styles, attitudes of Indian housewives are detailed.

There is also a study called FSRP which covers children in the age group of 10 – 19 years. Beside their demographics and psychographics, the study covers those areas such as

- Children as decision makers
- Role model of Indian children
- Pocket money and its usage
- Media reviews
- Favoured Personalities and characteristics and
- Brand awareness and advertising recall

Syndicated sources consists of market research firms offering syndicated services. These market research organisations, collects and updates information on a continues basis. Since data is syndicated, their cost is spread over a number of client organisations and hence cheaper. For example: A client firm can give certain specific question to be included in the questionnaire, which is used routinely to collect syndicated data. The client will have to pay extra for these. The data generated by these additional questions and analysis of such data will be revealed only to the firms submitting the questions. Therefore we can say, customization of secondary data is possible. Some areas of syndicated services are newspapers, magazine readership, TV channel popularity etc. Data from syndicated sources are available on a weekly or monthly basis.

Syndicated data may be classified as

(a) Consumer purchase data

(b) Retailer and wholesaler data

(c) Advertising data.

Most of these data collection methods as above are also called as syndicated data. Syndicated data can be classified into

Consumer Purchase Data or Panel type Data

This is one type of syndicated data. In this method, there are consumer panels. Members of this panel will be representative of the entire population. Panel members keep diaries in which they record all purchase, made by them. Product purchased, ranges from packaged food, to personal care products. Members submit the dairies every month to the organizations, for which, they are paid. This panel data can be used to find out the sale of the product. These panel data also gives an insight into repeat purchases, effect of free samples, coupon redemption etc.

The consumer panel data also gives profile of the target audience. Nowadays, diaries are replaced by hand held scanners. Panels also provide data on consumer buying habits on petrol, auto parts, sports goods etc.

Limitations

- Low income groups are not represented
- Some people do not want to take the trouble of keeping the record of the purchases. Hence data is not available.

Advantages

- Use of scanner tied to the central computer helps the panel members to record their purchases early (Almost immediately)
- It also provides reliability and speed.
- Panel can consist of only senior citizens or only children.

We also have consumer mail panel (CMP). This consists of members who are willing to answer mail questionnaire. A large number of such households are kept on the panel. This serves as a universe, through which panels are selected.

Retail and Wholesale Data

Marketing research is done in a retail store. These are organizations which provide continuous data on grocery products. The procedure does not involve questioning people and also does not rely on their memory. This requires cooperation, from the retailer to allow auditing to be done. Generally, retail audit involves counting of stocks between two consecutive visits. It involves inspection of goods delivered between visits. If the stock of any product in the shop is accurately counted, on both the visits and data on deliveries are accurately taken from the records, the collection of sales of a product over that period can be determined accurately as follows:

Initial stock + Deliveries between visits – second time stock = sales

If this information is obtained from different shops from the representative sample of shops, then the accurate estimates of sales of the product can be made. To do this, some shops can be taken as a “Panel of shops” representing the universe.

Advantages

- It provides information on consumer purchase over the counter between audits in specific units. For Example, KGs, bottles, No’s etc.
- It provides data on shop purchases i.e., the purchases made by the retailer between audits.
- The manufacturer comes to know “How competitor is doing?”

- It is very reliable method

Disadvantages

- Experience is needed by the market researcher
- Cooperation is required from the retail shop
- It is time consuming

Advertising Data

Since large amount of money is spent on advertising, data need to be collected on advertising. One way of recording is, by using passive meter. This is attached to a TV set and it records when the set was "On". It will record "How long a channel is viewed". By this method, data regarding audience interest in a channel can be found out. One thing to be noticed from the above is that, it only tells you that someone is viewing TV at home. But it does not tell you "Who is viewing at home". To find out "Who is viewing" a new instrument called "People's Meter" is introduced. This is a remote controlled instrument with buttons. Each household is given a specific button. When the button is pressed, it signals the control box that a specific person is viewing. This information is recorded electronically and sent to a computer that stores this information and subsequently it is analysed.

10.3 MISCELLANEOUS SECONDARY DATA

Includes trade association such as FICCI, CEI, Institution of Engineers, chamber of Commerce, Libraries such as public library, University Library etc., literature, state and central government publications, private sources such as all India Management Association (AIMA), Financial Express and Financial Dailies, world bodies and international organizations such as IMF, ADB etc.

Advantages and Disadvantages of Secondary Data

Advantages

(a) It is economical, no need to hire field people

(b) It saves time, normally 2 to 3 months time is saved, if data is available on hand and it can be tabulated in minutes.

(c) They provide information, which the retailers may not be willing to give to the researcher.

(d) No training is required to collect the data unlike primary data.

Disadvantages

Because secondary data had been collected for some other projects. So, it may not fit in to the problem, that is being defined. In some cases, the fit is so poor that, the data becomes completely inappropriate. It may be ill suited because of the following three reasons:

- Unit of measurement
- Problem of Accuracy
- Recency

Unit of Measurement

It is common for secondary data to be expressed in units. Example: Size of the retail establishments, for instance, can be expressed in terms of gross sales, profits, square

feet area and number of employees. Consumer income can be expressed by individual, family, household etc.

Secondary data available may not fit this.

Assume that the class intervals used is quite different from those which are needed. ***Example:*** Data available with respect to age group is as follows :

<18 year

18 – 24 years

25 – 34 years

35 – 44 years

Suppose the company needs a classification less than 20, 20 – 30 and 30 – 40, the above data classification of secondary data cannot be used.

Problem of Accuracy

The accuracy of secondary data is highly questionable. A number of errors are possible, in collection and analysis of the data. Accuracy of secondary data depends on

(a) Who collected the data?

(b) How are the data collected?

(a) ***Who collected the data?***

Reputation of the source decides the accuracy of the data. Assume that a private magazine publisher conducts a survey of its readers. The main aim of the survey is to find out the opinion of its reader about advertisement appearing in it. This survey is done by the publisher with a hope that other firms will buy this data before inserting advertisement.

Assume that a professional M.R agency has conducted a similar survey and selling its syndicated data on many magazines.

If you are a person, who wants information on a particular magazine, you buy the data from M.R agency rather from the magazine publisher. Reason for this is trust on M.R agency. The reason for trusting the MR agency is as follows.

1. Being an independent agency, there is no bias. The M.R agency is likely to provide an unbiased data.
2. The data quality of M.R agency will be good, since they are professionals.

(b) ***How was the data collected?***

1. What instruments was used?
2. What type of sampling was done?
3. How large was the sample?
4. What was the time period of data collection? Example: Days of the week, time of the day.

Recency

This refers to “How old is the information?” If it is five years old, it may be useless. Therefore, publication lag is a problem.

Secondary data used to choose a TV movie channel for advertising products & services.

Top 10 Advertisers in English General Entertainment channels
HLL
L'Oreal
Coca Cola
Nestle
Nokia
Pepsi
Brooke Bond Lipton
Titan Industries
Tata Motors
Ponds

Secondary data of a print media to unable the advertisers to choose suitable magazines.

Top ten magazines (All India - urban+rural):

- Saras Salil leads here with a readership of 6981 thousand
- India Today (Hindi) - 4314 thousand (Exhibit 12.4)
- India Today (English) - 4188 thousand
- Grihshobha - 3757 thousand
- Vanitha - 3270 thousand
- Pratiyogita Darpan - 2743 thousand
- Readers' Digest - 2566 thousand
- Filmfare - 2542 thousand
- Meri Saheli - 2405 thousand
- Sarita - 2189 thousand

Secondary data of radio stations to choose a broad cast channel for inserting an ad.

Total Radio Stations after phase II rollout

Player	Total Stations	Of the top 13 towns (A + and A Category)
Adlabs	44	7
South Asia/Kaal Radio	40	10
ENIL	32	13
Radio City	20	11
Dainik Bhaskar	17	4
Bag Films	10	0
Zee/Century	8	0
Thanthi/Today/Midday	7	1/3/7
HT/Positive/Raj Pat	4	40/1
Red FM	3	3

10.4 TOOLS FOR DATA COLLECTION

Observation and Questioning are two broad approaches available for primary data collection. The major difference between the two approaches is that, in questioning process, respondent play an active role, because of interaction with the researcher.

Observation Method

In observation method, only present / current behaviour can be studied. Therefore many researchers feel that this is a great disadvantage. A causal observation can enlighten the researcher to identify the problem. Such as length of the queue in front of a food chain, price and advertising activity of the competitor etc. observation is the least expensive of data collection.

Example 1: Suppose a safety week is celebrated and public is made aware of safety precautions to be observed while walking on the road. After one week, an observer can stand at a street corner and observe the No. of people walking on footpath and those walking on the road during a time period. This will tell him whether the campaign on safety is successful or unsuccessful.

Sometimes observation will be the only method available to the researcher.

Example 2: Behaviour or attitude of children, and also of those who are inarticulate.

Types of Observation Methods

There are several methods of observation of which, any one or a combination of some of them, can be used by the observer. They are:

- Structured or unstructured observation methods
- Disguised or undisguised observation methods
- Direct-indirect observation
- Human-mechanical observation

Structured-Unstructured Observation Methods

Whether the observation should be structured or unstructured depends on the data needed.

Example 1: A Manager of a hotel wants to know "How many of his customers visit the hotel with family and how many visits as single customer". Here observation is structured, since it is clear "what is to be observed". He may tell the waiters to record this. This information is required to decide the tables and chairs requirement and also the layout.

Suppose, the Manager wants to know how single customer and customer with family behave and what is their mood. This study is vague, it needs non-structured observation.

It is easier to record structured observation than non structured observation.

Example 2: To distinguish between structured and unstructured observation, consider a study, investigating the amount of search that goes into a "soap purchase". On the one hand, the observers could be instructed to stand at one end of a supermarket and record each sample customer's search. This may be observed and recorded as follows. "Purchaser first paused after looking at HLL brand". He looked at the price on of the product, kept the product back on the shelf, then picked up a soap cake of HLL and glanced at the picture on the pack and its list of ingredients, and kept it back. He then checked the label and price for P&G product, kept that back down again, and after a slight pause, picked up a different flavor soap of M/S Godrej company and placed it in his trolley and moved down the aisle. On the other hand, observers might simply be told to record the "First soap cake examined", by checking the appropriate boxes in the observation form. The "second situation" represents more structured than the first.

To use more structured approach, it would be necessary to decide precisely, what is to be observed and the specific categories and units that would be used to record the observations.

Disguised-Undisguised Observation Methods

In Disguised observation, the respondents do not know that they are being observed. In non disguised observation, the respondents are well aware that they are being observed. In disguised observation, many times observers pose as shoppers. They are called as "mystery shoppers". They are paid by the research organisations. The main strength of disguised observation is that, it allows for maintaining the true reactions of the individuals.

In undisguised method, observation may be contained due to induced error by the objects of observation. The ethical aspect of disguised observations is still questionable.

Direct-Indirect Observation

In direct observation, the actual behaviour or phenomenon of interest is observed. In Indirect observation, results of the consequences of the phenomenon are observed. Suppose, researcher is interested in knowing about the soft drink consumption of a student in a hostel room. He may like to observe empty soft drink bottles dropped into the bin. Similarly, the observer may seek the permission of the hotel owner, to visit the kitchen or stores. He may carry out a kitchen / stores audit, to find out the consumption of various brands of spice items being used by the Hotel. It may be noted that, the success of an indirect observation largely depends on "How best the observer is able to identify physical evidence of the problem under study".

Human-Mechanical Observation

Most of the studies in marketing research based on human observation, wherein trained observers are required to observe and record their observations. In some cases, mechanical devices such as eye cameras are used for observation. One of the major advantages of electrical / mechanical devices is that, their recordings are free from subjective bias.

Advantages of Observation Method

1. The original data can be collected at the time of occurrence of the event.
2. Observation is done in natural surroundings. Therefore facts are known, where questionnaire, experiments have environmental as well as time constraint.
3. Sometimes the respondents may not like to part with some of the information. Those information can be got by the researcher by observation.
4. Observation can be done on those who cannot articulate.
5. Bias of the researcher is greatly reduced in observation method.

Limitations

1. The observer might be waiting at the point of observation. Still the desired event may not take place i.e. observation is required over a long period of time and hence delay may occur.
2. For observation, extensive training of observers is required.
3. This is an expensive method.
4. External observation gives only surface indications. To go beneath the surface it is very difficult. So only overt behaviour can be observed.
5. Two observers, may observe the same event but may draw inference differently.
6. It is very difficult to gather information on (1) Opinions (2) Intentions etc.

10.5 DESIGNING THE QUESTIONNAIRE

Questionnaire, its Importance and Characteristics

Questionnaire: A questionnaire is a tool used to collect the data.

Importance of Questionnaire in MR: To study

1. Behavior, past and present
2. Demographic characteristics such as age, sex, income, occupation
3. Attitudes and opinions
4. Level of knowledge

Characteristics of Questionnaire

1. It must be simple. Respondent should be able to understand the questions
2. It must generate replies, which can be easily recorded by the interviewer
3. It should be specific, so as to allow the interviewer to keep the interview to the point
4. It should be well arranged, to facilitate analysis and interpretation
5. It must keep the respondent interested throughout

Different Types of Questionnaire

1. Structured non disguised Questionnaire
2. Structured disguised Questionnaire
3. Non structured disguised Questionnaire
4. Non structured-Non disguised Questionnaire

1. ***Structured non disguised Questionnaire:*** Here, questions are structured so as to get the facts. The interviewer will ask the questions strictly as per the pre arranged order. E.g: What are the strengths of soap A in comparison with soap B?
    - Cost is less
    - Lasts longer
    - Better fragrance
    - Produces more lather
    - Comes in more convenient sizes

Structured, non disguised is widely used in market research. Questions are presented with exactly the same wording and same order to all the respondents. The reason for standardizing question is, to ensure that all respondents reply the same question. The purpose of the question is clear. The researcher wants the respondent to choose one of the five options given above. This type of questionnaire is easy to administer. The respondents have no difficulty in answering. Because it is structured, the frame of reference is obvious.

In a non-disguised type, the purpose of the questionnaire is known to the respondent.

Example: "Subjects attitude towards cyber laws and need for government legislation to regulate it."

Certainly not needed at present

Certainly not needed

I can't say

Very urgently needed

Not urgently needed

2. ***Structured disguised Questionnaire:*** This type of questionnaire is least used in Marketing research. This type of Questionnaire is used to find, peoples' attitude, when a direct undisguised question produces a bias. In this type of questionnaire what comes out is "What does the respondent know rather than what he feels". Therefore attempt in this method is to find the respondent's attitude.

Currently the "office of profit" bill is

(a) In the Loksabha for approval.

(b) Approved by Loksabha and pending in Rajyasabha.

(c) Passed by both the houses, pending presidential approval.

(d) Bill passed by the president.

Depending on which answer, respondent chooses, his knowledge on the subject is decided.

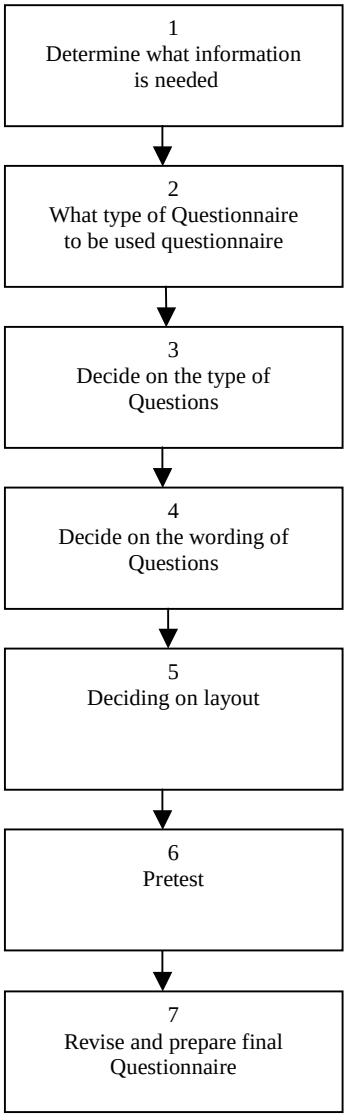
In a disguised type, the respondent is not revealed the purpose of the questionnaire. Here the purpose is to hide "What is expected from the respondent?" E.g. (1) "Tell me your opinion about Mr. Ben's healing effect show conducted at Bangalore?" E.g. (2) "What do you think regarding Babri Masjid demolition?"

3. ***Non-Structured and disguised Questionnaire:*** The main objective is to conceal the topic of enquiry by using a disguised stimulus. Though the stimulus is standardized by researcher, respondent is allowed to answer in an unstructured manner. The assumption made here is that individuals reaction is an indication of respondent's basic perception. Projective techniques are examples of Non structured disguised technique. The techniques involve the use of a vague stimulus, that an individual is asked to expand or describe or build a story, three common types under this category are (a) Word association (b) Sentence completion (c) Story telling.

4. ***Non structured - Non disguised Questionnaire:*** Here the purpose of the study is clear, but the responses to the question is open ended. Example: "How do you feel about the cyber law currently in practice and its need for further modification"? The initial part of the question is constant. After presenting the initial question, the interview becomes very unstructured as the interviewer probes more deeply. Respondents subsequent answer determines the direction the interviewer takes next. The question asked by interviewer varies from person to person. This method is called "Depth interview". The major advantage of this method is freedom permitted to the interviewer. By not restricting the respondents for a set of replies, the experienced interviewers will be above to get the information from the respondent fairly and accurately. The main disadvantage of this method of interviewing is that, it takes time, and respondents may not co-operate. Another disadvantage is that coding of open ended question may pose a challenge. E.g.: When a researcher asked the respondent "Tell me something about your experience in this hospital". The answer may be "Well, the nurses are "slow" to attend and Doctor is "rude". 'Slow' and 'rude' are different qualities needing separate coding. This type of interviewing is extremely helpful in exploratory studies.

10.6 QESTIONNAIRE DESIGNING

The following are the 7 steps:



10.6.1 Determine what Information is Required

The first question to be asked by market researcher is "What type of information he needs from the survey?" This is valid because, if he omits some information on relevant and vital aspects, his research is not likely to be successful. On the other hand, if he collects information which is not relevant, he is wasting his time and money.

At this stage, information required, and the scope of research should be clear. Therefore the steps to be followed at the planning stage is,

1. Decide the research issue
2. Get additional information on the research issue, from secondary data and exploratory research. The exploratory research will suggest "what are the relevant variables?"
3. Gather, what has been the experience with similar study
4. The type of information required. There are several types of information such as a) awareness, b) facts, c) opinions, d) attitudes, e) future plans, f) reasons.

Facts are usually sought out in marketing research

Example 1: Which television programme did you see last Saturday? This needs memory and respondent may not remember. This is known as recall loss. Therefore Questioning the distant past should be avoided. Memory of events depends on 1) Importance of the events (2) Whether it is necessary for the respondent to remember. In the above case, both the factors are not fulfilled. Therefore the respondent does not remember. On the contrary birthday or wedding day of individuals is remembered without effort since the event is important. Therefore researcher should be careful while asking questions of the past. First, he must make sure that, the respondent has the answer.

Example 2: Do you go to club? He may say 'yes', though it is not true. This may be because the respondent wants to impress upon the interviewer that he belongs to a well-to do family and can afford to spend money on club. To get facts, the respondents must be conditioned (by good support) to part with the correct facts.

10.6.2 Mode of Collecting the Data

The Questionnaire can be used to collect information either through personal interview, mail or telephone. The method chosen depends on the information required and also the type of respondent. If the information is to be collected from illiterate, questionnaire would be a wrong choice.

10.6.3 Type of Questions

Open Ended Questions

These are questions, where respondents are free to answer, in their own words. Example: "What factor do you consider to buy a suit"? If multiple choices are given, it could be colour, price, style, brand etc., but some respondents may mention items which may not occur to the researcher.

Therefore open ended questions are useful in exploratory research, where all possible alternatives are explored. The greatest disadvantage of open ended questions is that, researcher has to note down the answer of the respondents verbatim. Therefore, there is a possibility of researcher failing to record some information.

Another problem of open ended question is that, the respondents may not use the same frame of reference.

Example: "What is the most important attribute in a job?"

Ans: Pay

The respondent meant "Basic pay" but interviewer may think that, the respondent is talking about "Total pay including dearness allowance and incentive". Since both of them refer to pay, it is impossible to separate two different frames.

Dichotomous Questions

These questions have only two answers, "Yes" or "no", "true" or false" "use" or "don't use".

Do you use toothpaste? Yes …….. No ……

There is no third answer. However, some times, there can be a third answer: Example: "Do you like to watch movies?"

Ans: Neither like nor dislike

Dichotomous question are most convenient and easy to answer.

Close End Questions

There are two basic formats in this type:

- Make one or more choices among the alternatives
- Rate the alternatives

Choice among Alternatives:

Which one of the following words or phrase best describes the kind of person you feel would be most likely to use this product based on what you have seen in the commercial.

(a) Young …… old …….

Single …… Married ……..

Modern …… Old fashioned ……...

(b) Rating Scale

(I) Please tell us your overall reaction to this commercial?

1. A great commercial, would like to see again
2. Just so, so like other commercials
3. Another bad commercial
4. Pretty good commercial

(II) Based on what you saw in the commercial, how interested do you feel, you would be buying the products?

- Definitely
- Probably would buy
- May or may not buy
- Probably would not buy
- Definitely would not buy

Closed ended questionnaire are easy to answer. It requires less effort by the interviewer. Tabulation, analysis is easier. There is less error, since same questions are asked to everyone. Time taken to respond is less. We can compare the answer of one respondent to another respondent.

One basic criticism of closed ended questionnaire is that, middle alternatives are not included in this. Such as "don't know". This will force the respondents, to choose among the given alternative.

10.6.4 Question Wording

Wordings of particular questions can have a large impact on how respondent interprets. Even a small shift in the wording can shift respondent's answer.

Example 1: "Don't you think that, Brazil played poorly in the FIFA cup?" The answer will be "yes". Many of them, who do not have any idea about the game, will also say "yes". If the question is worded slightly differently, the response will be different.

Example 2: "Do you think that, Brazil played poorly in the FIFA cup?" This is a straight forward question. The answer could be "yes", "no" or "don't know" depending on the knowledge the respondents have about the game.

One word change as above, different responses will be given by respondents.

Guidelines towards the use of correct wording

Is vocabulary simple, and familiar to the respondents?

Example 1: Instead of using the work "reasonably", "usually", "occasionally", "generally", "on the whole".

Example 2: "How often do you go to a movie? Often, may be once a week, once a month, once in two months or even more.

Avoid Double Barreled Questions

These are questions, in which respondent can agree with one part of the question, but not agree with the other or cannot answer without making a particular assumption.

Example 1: "Do you feel, firms today are employee oriented and customer oriented" There are two separate issues here - [yes] [No]

Example 2: "Are you happy with the price and quality of Branded shampoo?" [yes] [No]

Avoid Leading And Loading Questions

Leading

Leading question is one, which suggests the answer to the respondent. The question itself will influence the answer, when respondents get an idea that the data is being collected by a company, respondents have a tendency to respond positively. Example 1; "How do you like the programme on "Radio Mirchy"? The answer is likely to be "yes". The unbiased way of asking is "which is your favorite FM Radio station? The answer could be any one of the four stations namely 1. Radio City 2. Mirchy 3. Rainbow 4. Radio-One.

Loading

A leading question is also known as loaded question. In loading, special emphasis is given to a word or a phrase, which acts as a lead to respondent. Example: "Do you own a kelvinator refrigerator". Better question would be "what brand of refrigerator do you own? Don't you think the civic body is "incompetent". Here incompetent is 'loaded'.

Are The Questions Confusing?

If there is a question, which is not clear or confusing, then the respondent gets more biased rather that getting enlightened. Example: "Do you think that the Government published book is distributed effectively"? This is not the correct way, since respondent does not know what is the meaning of the word effective distribution. This is confusing. The correct way of asking questions is "Do you think that the Government published books are readily available when you want to buy?" Example: "Do you think whether value price equation is attractive"? Here respondents may not know the meaning of value price equation.

10.6.5 Applicability

"Is the question applicable to all respondents"? Respondents may try to answer a question even though, they don't qualify to do so or may lack opinion. Example 1: "What is your present education level" 2. "Where are you working" (assume he is employed) 3. "From which bank have you taken housing loan" (assume he has taken loan).

Avoid implicit assumptions

An implicit alternative, is one that is not expressed in the options. Consider the 2 following questions,

Would you like to have a job, if it is possible?
Would you prefer to have a job, or do you prefer to do just domestic work.

Even though, we may say that the 2 questions look similar, they vary widely. The difference is that, in Q-2 makes explicit the alternative implied in Q-1.

10.6.6 Split Ballot Technique

This is a procedure used wherein 1. The question is split into two halves and

2. Different sequencing of questions is administered to each half. There are occasions when a single version of questions may not derive the correct answer and the choice is not obvious to the respondent.

Example: "Why do you use Ayurvedic soap"? One respondent might say "Ayurvedic soap is better for skin care". Another may say "Dermatologist recommended". Third might say "It is a soap used by the entire family for several years". The first respondent is answering "The reason for using it at present". The second responded is answering. "How he started using". The third respondent, "Stating family tradition for using". As can be seen, different reference frames are used. The question may be balanced and asked.

Are The Questions Too Long?

Generally as a thumb rule it is advisable to keep the number of words in a question not exceeding 20. The question given below is too long for the respondent to comprehend, to answer.

10.6.7 Participation at the expense of Accuracy

Some times the respondent may not have the information that is necessary by the researcher.

Example 1: The husband is asked a question "How much does your family spend on groceries in a week" Unless the respondent does the grocery shopping himself, he will not know what he has spent. In a situation like this, it will be helpful to ask "filtered question". Example of filtered question may be "Who buys grocery in your family"?

Example 2: "Do you have the information of Mr. Ben's visit to Bangalore"? Not only should the individual have the information but also he or she should remember it. The inability to remember the information is called as "recall loss".

10.6.8 Pre-testing of Questionnaire

Pre-testing of a questionnaire is done to detect any flaws as follows. E.g. Word used by the researcher must convey the same meaning to all the respondents. Are instructions to skip questions clear? One of the prime conditions for pre testing is, sample chosen for pre testing should be similar to the respondents who are going to participate ultimately. Just because, a few chosen respondents fill in all the questions, it does not mean that, questionnaire is sound.

How Many Question To Be Asked?

Questionnaire should not be too long as response will be poor. There is no rule to decide this. However, the researcher should know that if he was the respondent, how would he react to a lengthy questionnaire. One way of deciding the length of the questionnaire is to calculate the time taken to complete the questionnaire. He can give the questionnaire to a few known people to seek their opinion.

10.7 MAIL QUESTIONNAIRE

10.7.1 Advantages

1. Easier to reach large number of respondents throughout the country
2. Since interviewer is not present face to face, influence of interviewer on the respondent is eliminated.

3. Where the questions asked, is such that, it cannot be answered immediately, and needs some thinking on the part of the respondent, Respondent can think over leisurely and give the answer
4. Saves cost (cheaper than interview)
5. No need to train interviewers
6. Personal and sensitive questions are well answered

10.7.2 Limitations

1. It is not suitable, when questions are difficult and complicated. Example: "Do you believe in value price relation ship"?
2. When the researcher is interested in spontaneous response, this method is unsuitable. Because, thinking time given to respondent will influence the answer. Example: "Tell me spontaneously, what comes to your mind if I ask you about cigarette smoking".
3. In case of mail questionnaire, it is not possible to verify whether the respondent himself / herself has filled the questionnaire. If questionnaire is directed towards the housewife, to find expenditure on kitchen items, she is supposed to answer it. Instead if her husband answers the questionnaire, the answer may not be correct.
4. Any clarification required by the respondent regarding questions, is not possible. Example: Prorated discount, product profile, marginal rate etc. may not be understood by the respondents.
5. If the answers are not correct, the researcher cannot probe further
6. Poor response (30%) - Not all reply.

10.8 SAMPLE QUESTIONNAIRES

10.8.1 A Study of Customer Retention as Adopted by Textile Retail Outlets

Note: Information gathered will be strictly confidential. We highly appreciate your cooperation in this regard.

1. Name of the outlet:
2. Address:
3. Do you have regular customers?

   Yes [ ] No [ ]
4. How often your regular customer visits your outlet?

   Weekly [ ] Once in a month [ ] Twice in a month [ ]

   Once in 2 months [ ] 2 - 3 months [ ] Once in 6 months [ ]
5. Do you maintain any records of your regular customers?

   Yes [ ] No [ ]
6. What percentage of your customers are regular? % [ ]
7. Do you think that we can use the above as a retention strategy of customers for your outlets?

   Yes [ ] No [ ]
8. What are the different products that you handle in your outlets?

   Formals [ ] Casuals Kids wear [ ] Ladies dress materials [ ]

   Sarees [ ] Others (Specify)

9. What type of customers (socio-economic) visits your outlets?

   Low income [ ] Middle income [ ] High income [ ]

10. Why do you think they come to your outlet?

    Product variety [ ] Price discount [ ] Easy gain to products [ ]
    Parking facility [ ] Store layout [ ] Quality [ ] Reasonable price [ ]
    Others (Specify)

11. Rank the factors that influence the customer to visit your outlet:

    Credit facility [ ] Price discount [ ] Gifts [ ] Easy gain to products [ ]
    Parking facility [ ] Store layout [ ] Product variety [ ]

    Quality and reasonable price [ ] Others (Specify) ----------

12. What do customers expect from the retail outlet?

    Credit facility [ ] Gift coupon [ ] Price discount [ ]

    Price reduction easy accessibility of product [ ] Quality and reasonable price [ ]
    Other (Specify) ----------

13. Do you have any retention strategy adopted to keep in touch with the customer?

    Gifts on special occasion

(a) Birthday gift [ ] (b) Anniversary [ ] (c) Festivals Customer relationship [ ]

    Others (Specify) ----------

14. Which one do you think is most effective, please rank them?

    (a) Birthday gift [ ] (b) Anniversary [ ] (c) Festivals Customer relationship [ ]

    Others (Specify) ----------

Thanking You for Sparing Your Valuable Time

10.8.2 A Study on Customer Preferences of P.C.

Date:
Place:

Form No: [ ] [ ] [ ] [ ] [ ]

1. Personal Profile

   (a) Name: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

   (b) Address: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
   [ ]
   [ ]

   (c) Sex: Male [ ] Female [ ]

   (d) Age: [ ] [ ] years

   (e) Occupation: Self-employed [ ] Professional [ ] Service [ ] Housewife [ ]

2. Do you own a P.C? Yes [ ] No [ ]

   (a) If yes, whether: Branded [ ] unbranded [ ]

   (b) If no, do you plan to buy it? Near future [ ] Distant future [ ] Can't say [ ]
   (Less than 6 months) (Less than a year)
   If so, whether: Branded [ ] unbranded [ ]

3. What is the utility of the PC to you?

   Education [ ] Business [ ] Entertainment [ ] Internet / Communication [ ]

4. What is the most important factor that matters while buying a PC?

   Quality [ ] Price [ ] Service [ ] Finance facility [ ]

5. Before deciding on vendor, which factor goes into your consideration?

   Vendors Reputation [ ] Technical Expertise [ ] Client Base [ ]

6. How did you come to know about the vendor?

   Friendly / Family [ ] Press Adds [ ] Direct Mailers [ ] Reference Website [ ]

7. Which configuration would you decide on while buying a PC?

   Standard [ ] Intermediate [ ] Latest / Advanced [ ]

8. In your PC, would you prefer? Conventional Design [ ] Innovative Design [ ]

   if new, Why: New design distract attention -

   New design means increased price -

   New design is hard to adapt -

   If Innovative, why: To create own identify

   Out of business need -

   Space management -

9. Rate the following four factors important for innovative design, starting with the most preferred:

   A) Size B) Shape C) Colour / ordinary D) Portability and Sturdiness

   1. ---------- 3. ----------

   2. ---------- 4. ----------

10. To what extent the computer would increase your efficiency?

    Negligible [ ] 20 - 40% [ ] 40 - 60% [ ] More [ ]

11. How many hours on an average per week would you use your PC?

    0 to 5 hours [ ] 6 to 12 hours [ ] 13 to 18 hours [ ] More [ ]

12. While using your PC most of the time would be given for:

    Education [ ] Accounting [ ] Net surfing [ ] correspondence [ ]

13. Remarks ----------

Signature of Respondent ----------

10.8.3 Questionnaire (Dealers)

" Survey on dealers / consumers preference of different brands of cements in Tumkur"

Dear Sir / Madan,

The information gathered is strictly used for academe purpose. We highly appreciate

your co-operation in this regard.

Name ……..

Address ……..

……..

Phone No. ……..

1. How long are you in Cement Business ?

Below 1 Year	
1 - 5 years	
5 - 10 years	
Above 10 years	

2. Rank your major consumers ?

Consumers	Rank
Institutions / companies	
Individuals	
Building Promoters / Construction Companies	
Government Agencies	
Small contractors	

3. Rank the following brands do you sell according to volume ?

Brands	Rank
1. Diamond	
2. L & T	
3. Ramco	
4. Rassi	
5. Birla Super	
6. Shankar	
7. ACC	
8. Coramandel	
9. Others	

4. Rank the following brands that are mostly preferred by consumers.

Brands, Institutions, Individuals, Govt. Small Building, Companies, Agencies Contractors, Promoters

1. Diamond
2. L&T
3. Ramco
4. Raasi
5. Birla Super
6. Shankar
7. ACC
8. Coramandel
9. Others

5 Rank you're the factors that influence you to stock and sell the following brands.

Factors	Rank
1. Quality	
2. Consumer requirements	
3. Attractive Margins	
4. Dealer Incentive	
5. Others	

6. Mention any promotional activities from your end

Promotional Activities	Yes	No
Quantity discount		
Price discount		
Free Transportation		
Free technical advise / information		

7. Rank the following qualities that consumers look forward during their purchase of cements.

Qualities, Institutions, Individuals, Govt. Small Building, Companies, Agencies, Contractors, Promoters, Quick setting

Price

Durability

Availability

Brand

8. Mention the level of influence of the following factors on your sales behaviour

Factors, Extremely, Somewhat, Indifferent, Not very, Not at all, Influence

Quality

Consumers

Requirements

Attractive

Margin

Dealers

Incentives

Price

Others

Check Your Progress

Design a questionnaire for survey on consumer's preferences of mobile phone.

10.9 LET US SUM UP

Sometimes, secondary data may not be able to solve the research problem. In that case researcher need to turn towards primary data. Primary data may pertain to life style, income, awareness or any other attribute of individuals or groups. There are 2 ways of

collecting primary data namely. (a) Observation (b) By questioning the appropriate sample. Observation method has a limitation i.e., certain attitudes, knowledge, motivation etc. cannot be measured by this method. For this reason, researcher needs to communicate.

Communication method is classified based on whether it is structured or disguised. Structured questionnaire is easy to administer. This type is most suited for descriptive research. If the researcher wants to do exploratory sturdy, unstructured method is better. In unstructured method questions will have to be framed based on the answer by the respondent. In disguised questionnaire, the purpose of research is not disclosed to respondents. This is done so that the respondents might speak the truth instead of giving some answer which satisfies the researcher.

Questionnaire can be administered either in person or on-line or Mail questionnaire. Each of these methods have advantages and disadvantages. Questions in a questionnaire may be classified into (a) Open question (b) Close ended questions (c) Dichotomous questions etc. While formulating questions, care has to be taken with respect to question wording, vocabulary, leading, loading and confusing questions should be avoided. Further it is desirable that questions should not be complex, nor too long. It is also implied that proper sequencing will enable the respondent to answer the question easily. The researcher must maintain a balanced scale and must use a funnel approach. Pretesting of the questionnaire is preferred before introducing to a large population. Personal interview to gather information is very costly. Therefore sometimes mail questionnaire is used by researcher to collect the data. However it has its own limitations.

Secondary data are statistics that already exists. These may not be readily used because these data are collected for some other purpose. There are 2 types of secondary data (1) Internal and (2) External secondary data. Census is the most important among secondary data. Syndicated data is an important form of secondary data which may be classified into (a) Consumer purchase data (b) Retailer and wholesale data (c) Advertising data. Each has advantages and disadvantages. Secondary data has its own advantages and disadvantages.

10.10 LESSON-END ACTIVITIES

(i) List some major secondary sources of information for the following:

"Market research manager of a tea manufacturing company has to prepare a comprehensive report on the tea industry as a whole."

(ii) What observation technique would you use to gather the following information: "How do discounts influence the purchase behaviour of customers buying colour TV?"

10.11 KEYWORDS

Depth interview

Disguised

Undisguised

Unstructured observation

Mail questionnaire

Open ended questions

Closed ended questions

Dichotomous question

Double barrel question

Leading question

Split ballot technique

Pretest mail questionnaire

Internal data

External data

Syndicated data

Census panel

Retail / Wholesale data

Consumer purchase data

C.M.P

10.12 QUESTIONS FOR DISCUSSION

1. What is primary data?
2. What are the various methods available for collecting primary data?
3. What are the several methods used to collect data by observation method?
4. What are the advantages and limitations of collecting data by observation method?
5. What is a questionnaire? What are its different types?
6. What are the characteristics of a good questionnaire?
7. What are the limitations of a questionnaire?
8. Explain the steps involved in designing a questionnaire.
9. Explain Open ended & Closed ended questions in a questionnaire.
10. What is a split ballot method? When is it employed?
11. What is questionnaire pretesting?
12. What is a dichotomous question? When is it most appropriate?
13. How does a questionnaire suffer compared to experimentation on account of validity & reliability?
14. What is meant by pre testing of questionnaire? Why is it required?
15. Distinguish qualitative and quantitative method of data collection.
16. What is mail questionnaire? Explain the advantages and limitations of the same.
17. What is meant by leading / loading question give example?
18. What is meant by double barreled questions?
19. Design a questionnaire to study brand preference for a consumer durable product.
20. What is meant by secondary data?
21. What are the sources of secondary data?
22. What are the types of secondary data?
23. What are the special techniques of secondary data?
24. What are the classification of syndicated data?
25. What are the advantages and limitations of syndicated data?

26. What are the advantages and disadvantages of secondary data?
27. Discuss the sources of secondary data for the study on "consumer purchasing a white good".
28. Who are the top 10 advertisers in English movie channels?
29. What are the top 10 magazines?
30. What are the total radio stations of different companies after phase II roll out?

10.13 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods*, Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases"*, All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision-making"*, Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology- Methods and Techniques"*, Wiley Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics"*, D.B. Taraporevala Sons and Co. Private Limited, Bombay.

LESSON

11

PILOT STUDY

CONTENTS

11.0 AIMS AND OBJECTIVES

In this lesson we will study the steps involved in processing the data, editing and coding the data collected and measures of central tendency and dispersion. After studying this lesson, you will be able to:

(i) understand the concept of case study.

(ii) steps in processing data.

(iii) analyse data.

(iv) interpret data.

11.1 INTRODUCTION

This is essentially a small scale replica of the actual survey and it is carried out before the actual survey is undertaken. It should duplicate, as near as possible, the survey which is to be made because it may reveal snags in the proposed questions and methods.

A pilot survey is very useful when the actual survey is to be on a big scale as it may provide data which will allow costs to be trimmed. Also, a pilot survey will give an estimate of the non-response rate and it will also give a guide as to the adequacy of the sampling frame chosen.

11.2 CASE STUDY

The case study is one of several ways of doing social science research. Other ways include experiments, surveys, multiple histories, and analysis of archival information.

Rather than using large samples and following a rigid protocol to examine a limited number of variables, case study methods involve an in-depth, longitudinal examination of a single instance or event: a case. They provide a systematic way of looking at events, collecting data, analyzing information, and reporting the results. As a result the researcher may gain a sharpened understanding of why the instance happened as it did, and what might become important to look at more extensively in future research. Case studies lend themselves to both generating and testing hypotheses.

Yin, on the other hand, suggests that case study should be defined as a research strategy, an empirical inquiry that investigates a phenomenon within its real-life context. Case study research means single and multiple case studies, can include quantitative evidence, relies on multiple sources of evidence and benefits from the prior development of theoretical propositions. He notes that case studies should not be confused with qualitative research and points out that they can be based on any mix of quantitative and qualitative evidence. "The case study is a research approach, situated between concrete data taking techniques and methodological paradigms".

SOURCE: WIKIPEDIA

11.3 DATA PROCESSING

Data Processing

Processing data is very important in market research. After collecting the data. The next job of the researcher is to analyze and interpret the data. The purpose of analysis is to draw conclusion. There are two parts in processing the data.

(1) Data Analysis

(2) Interpretation of data

Analysis of the data involves organizing the data in a particular manner. Interpretation of data is a method for deriving conclusions from the data analyzed. Analysis of data is not complete, unless it is interpreted.

Steps in Processing of Data

1. Preparing raw data
2. Coding
3. Editing
4. Tabulation of data
5. Summarising the data
6. Usage of statistical tool.

11.3.1 Preparing Raw Data

Data collection is a significant part of market research. Even more significant is, to filter out the relevant data from the mass of data collected. Data continues to be in raw form, unless they are processed and analyzed.

Primary data collected by surveys, observations by field investigations are hastily entered into questionnaires. Due to the pressure of interviewing, the researcher has to write down the responses immediately. Many times this may not be systematic. The information so collected by field staff is called raw data.

The information collected may be illegible, incomplete and inaccurate to some extent. Also the information collected will be scattered in several data collection formats. The data lying in such a crude form are not ready for analysis. Keeping this in mind the researcher must take some measures to organize the data, so that it can be analyzed.

The various steps which are required to be taken for his purpose are (a) editing and (b) coding and (c) tabulating.

11.3.2 Coding

Coding refers to all those activities which helps in transforming edited questionnaires into a form which is ready for analysis. Coding speeds up the tabulation while editing eliminates errors. Coding involves assigning numbers or other symbols to answers, so that the responses can be grouped into limited number of classes or categories

Example: 1 is used for male and 2 for female.

Some guidelines to be followed in coding which is as follows.

1. Establishment of appropriate category
2. Mutual exclusivity
3. Single Dimension

Establishment of appropriate category

Example: Suppose the researcher is analysing the "inconvenience" that car owner is facing with his present model. Therefore the factor chosen for coding may be "inconvenience". Under this there could be 4 types (1) Inconvenience to enter the backseat (2) Inconvenience due to insufficient legroom (3) Inconvenience with respect to interior (4) Inconvenience in door locking, and dickey opening. Now the researcher may classify these 4 answers based on internal inconvenience and other inconvenience referring to exterior. Each is assigned a different number for the purpose of codification.

Mutually exclusive

This is important because, the answer given by the respondent should be placed under only one category. Example: Occupation of an individual may be answered as (1) Professional (2) Sales (3) Executive (4) Manager etc.

Some times respondents might think that, they belong to more than one category. This is because a sales personal, may do sales Job, therefore he should be placed under sales category. Also, he may be head, supervising the work of other sales executive. In this case he is doing a managerial function. Viewed in this context, he should be placed under manager category which has a different code. Therefore he can only be put under one category which is to be decided. One way of deciding this could be to analyse "which of 2 functions does he spend most time"?

Yet another scenario is that, assume that there is a salesman who is currently employed. Under column occupation, he will tick it as sales, under current employment column, he will mark unemployed. Therefore how to codify? Under which category he should be placed. One of the solutions is to have a classification, such as employed salesman, unemployed salesman to represent 2 separate category.

Questions	Answer	Codes
1. Do you own a vehicle	Yes	1
	No	2
2. What is your occupation	Salaried	S
	Business	B
	Retired	R
	Technical	T
	Consultant	C

11.3.3 Editing

The main purpose of editing is to eliminate errors and confusion. Editing involves inspection and correction of each questionnaire. The main role of editing is to identify commissions, ambiguities and errors in response.

Therefore editing means, the activity of inspecting, correcting and modifying the correct data.

This can be done in two stages (a) Field editing (b) Office editing

Field editing

A field editing has 2 objectives (a) To make sure that proper procedure is followed in selecting the respondent, interview them and record their responses. In field editing, speed is the main criteria, since editing should be done, when the study is still under progress. The main problems faced in field editing are

(1) Inappropriate respondents

(2) Incomplete interviews

(3) Improper understanding

(4) Lack of consistency

(5) Legibility

(6) Fictitious interview

Example:

1. ***Inappropriate respondents:*** It is intended to include "House owners" in the sample for conducting the survey. If "tenant" is interviewed, it would be wrong.
2. ***Incomplete interview:*** All questions are to be answered. There should not be any "blanks". Blank can have different meanings. E.g. (a) No answer (b) Refusal to answer (c) Question not applicable (d) Interviewer by over sight did not record. The reason for no answer could be that the respondent honestly does not know the answers. Sometimes the respondent is not answering, may be because of sensitivity or emotional aspect of the question
3. ***Lack of understanding:*** The interviewer in a hurry would have recorded some abbreviated answer. Later at the end of the day, he can't find out, what it meant.
4. ***Consistency:*** Earlier part of the questionnaire indicates that there are no children and in the later part, age of the children is mentioned.
5. ***Legibility:*** If what is said is not clear, the interviewer must clarify the same on the spot.
6. ***Fictitious interview:*** This amounts to cheating by the interviewer. Here questionnaires are filled without conducting interviews. Surprise check by superior is one way to minimize this.

Office editing

Office editing is more thorough than field editing. The job of office editor is more difficult than field editor. In case of mail questionnaire there are no other methods, except to conduct office audit. Examples are as below which illustrates the kind of problem faced

by office editor. Consistency, respondents rapport problems are some of the issues which gets highlighted in the office editing.

Example:

1. Respondent indicated that he doesn't drink coffee, but when questioned about the favourite brand, he said "Bru".
2. A rating scale given to a respondent states, semantic differential scale with 10 items. The respondent has ticked "strongly agree" to all the 10 items.
3. What is the most expensive purchase you have made in the last one year is the question. Two respondents answering as (1) LCD TV (2) Trip to USA.

In Example-1 above, there is inconsistency. There are two possibilities which an editor need to consider. (1) Was the respondent lying (2) Did the interviewer record wrongly. The editor has to look in to answer to other questions on beverages, and interpret the right answer.

In Example-2 above, it is to be remembered that semantic differential scale consists of items which has alternately positive and negative connotations. If a respondent has marked both positive and negative as "agreed", the only conclusion the editor can draw is that the respondent is filling the questionnaire without knowledge. Therefore editor will discord this questionnaire, since there are no alternatives.

In Example-3 above, both the respondents have answered correctly. The frame of reference is different. The main problem is, one of them is product, the other is a service while coding the data, the two answers should be put under two different categories.

Answers to open ended questions poses great difficulty in editing.

11.3.4 Tabulation of Data

Tabulation refers to counting the number of cases that fall into various categories. The results are summarized in the form of statistical tables. The raw data is divided into groups and subgroups. The counting and placing of data in particular group and subgroup are done. Tabulation involves

(1) Sorting and counting

(2) Summarizing of data

Tabulation may be of 2 types (1) simple tabulation (2) cross tabulation. In simple tabulation, a single variable is counted. Cross tabulation includes 2 or more variables, which are treated simultaneously. Tabulation can be done entirely by hand or by machine or both hand and machine.

The form in which tabulation is to be done is decided by taking into account. (1) Purpose of study and (2) use of statistical tools e.g. mean, mode, standard deviation etc. Improper tabulation may create difficulties in the use of the these tools.

Sorting and Counting of Data

Sorting by manual method is as follows:

Sorting of data

Income (Rs.)	*Tally Mark*	*Frequencies*
1,000	IIII	5
1,500	IIII III	8
2,000	IIII IIII II	12
2,500	IIII IIII IIII I	16

The above method is used commonly for sorting of data.

The tabulation may include table number, title, head note, stub, caption, sub entries, body of the table, footnote and source. The following example explains the component of a table.

Format of a Blank Table.

TABLE No.

TITLE - No. of children per family

Head Note - Unit of measurement

Sub Heading	Caption	Total
	Body	
	Foot note	

The table must have a clear and brief title. The head note, usually the measurement unit, is placed at the top of the table in the right hand corner in a bracket.

Stub indicates the row title or the row headings and is placed in the left-hand column. Caption indicates that each column is meant for.

Sub entries are sub-group of the stub. Body of the table given full information of the frequency.

Kinds of Tabulation

Simple or one way tabulation

The multiple choice questions which allow only one answer may use one way tabulation or univariate. The questions are predetermined and consists of counting the number of responses falling into a particular category and calculate the percentage. There may be 2 types of univariate tabulation:

(a) Question with only one response.

(b) Multiple response to question

Question with only one response

If question has only one answer, tabulation may be of the following type:

Table No. 1

Study of No. of children in a family

No. of children	Family	Percentage
0	10	5
1	30	15
2	70	35
3	60	30
4	20	10
More than 4	10	5
	200	100

Question with multiple response

Sometimes respondents may give more than one answer to a given question. In this case there will be an overlap and response when tabulated need not add to 100 percent.

Table No. 2

Choice of an automobile

What do you dislike about the car which you own at present?

Parameter	No. of respondents
Engine	10
Body	15
Mileage	15
Interior	06
Colour	18
Maintenance frequency	16
Inconvenience	20

There is duplication because respondents may be dissatisfied with mileage given by vehicle and also may dislike interior of the car. Here, there are more than one parameter to dislike the car by the car owner. Suppose we are tabulating the cause of inconvenience felt by the car owner, it can be classified as follows:

1. Cramped legroom
2. Rear seat problem
3. Difficulty to raising the window
4. Difficult in locking the door

Now the tabulation of each of the specific factors would help to identify the real problem for dislike.

Cross tabulation or 2-way tabulation

This is known as bivariate tabulation. The data may include 2 or more variable. Cross tabulation is very commonly used in market research.

Example: Popularity of a health drink among families having different income. Suppose 500 families are met and data collected is as follows:

Income per month	No. of children per family							No. of families
	0	1	2	3	4	5	More than 5	
<1000	5	0	8	9	11	15	25	73
1001-2000	10	5	8	10	13	18	27	91
2001-3000	20	10	12	14	20	22	32	130
3001-4000	12	3	6	7	13	20	30	91
4001-5000	6	2	6	5	10	15	20	64
> 5000	6	1	4	5	7	10	18	51
	59	21	44	50	74	100	152	500

Note: Table shows that consumption of a health drink not only depends on income but also on the number of children per family

Health drink is also very popular among the family with no children. This shows that even adults consume this drink. It is obvious from the table that, 59 out of 500 families consume health drink even though they have no children. Table also shows that families in the income group of 2001 to 3000 consume the health drink most.

11.3.5 Summarising the Data

Before taking up summarizing, the data should be classified into (1) Relevant data (2) Irrelevant data. During the field study, the researcher has collected lot of data which he may think would be of use. Summarizing the data includes (1) Classification of data (2) Frequency distribution (3) Use of appropriate statistical tool.

Classification of Data

(a) ***Number of Groups:*** Number of groups should be sufficient to record all possible data. Classification should not be too narrow. If it is too narrow, there can be an overlap.

Example: If a researcher is conducting a survey on "Why the current car owner dislikes the car"? The car owner may indicate the following:

(1) Difficulty in seeking entry to the back seat

(2) Interior space

(3) Cramped leg room

(4) Mileage

(5) Rattling of the engine

(6) Dickey space

Now all the above data can be classified into 2 or 3 categories such as (1) Discomfort (2) Expense (3) Pride (4) Safety (5) Design of the car.

(b) ***Width of the Class Interval:*** Class interval should be uniform and should be of equal width. This will give consistency in the data distribution.

(c) ***Exclusive categories:*** Classification made should be done in such a way that, the response can be placed in only one category.

Example: Problem of Leg room is the answer by respondent. This should be placed either under Discomfort or Design but not both.

(d) ***Exhaustive Categories:*** This should be made to include all responses including "Don't Know" answers. Sometimes this will influence the ultimate answer to the research problem.

(e) ***Avoid extremes:*** Avoid open ended class interval.

Check Your Progress

1. How pilot survey is an essence?
2. How coding is different from editing?
3. What is office editing?

11.3.6 Usage of Statistical Tools

Frequency distribution

Frequency distribution, simply reports the number of responses that each question received. Frequency distribution, organizes data into classes or groups. It shows the number of data that falls into particular class.

Example: of frequency distribution:

Income	No. of people
4000-6999	100
7000-9999	122
10000-12999	140

In marketing research central value or tendency plays a very important role. The researcher may be interested in knowing the average sales/shop, average consumption per month etc. The population parameters can be calculated with the help of simple average. The average of sample may be taken as population parameter. E.g. If the average income of the population is to be computed, the researcher may select a sample, collect data on family income and calculate the relevant statistics which will be a representative of the population.

The total purchasing power of the community can be estimated on sample average. If the sample is stratified, the purchasing power of each income class may also be estimated. The median figure will reveal that half the population has more income than the median income, and half the population has less income than median income. The mode will reveal the most common frequency. Based on this, shoppers can play their strategy to sell the product.

The 3 most common ways to measure centrality or central tendency is mode, median and mean.

Mode

The mode is the central value or item, that occurs most often, when data is categorized in a frequency distribution, it is very easy to identify the mode, since the category in which the mode lies has the greatest number of observations.

Example: Data regarding household income of 300 people as tabulated by researcher.

Income (Rs.)	Number (f)	Cumulative Frequency
upto 10000	30	30
10000-14999	125	155
20000-24999	50	205
25000-29999	30	235
30000-34999	33	268
35000-49999	20	288
above 35000	12	300

In the above table 125 is the modal class

Mode can be calculated using the formula:

$$M_0 = LM_0 \left[\frac{D_1}{D_1 + D_2} \right] \times i$$

LM_0 = Lower limit of modal class

D_1= Difference between the frequency of modal class and the class immediately preceding the modal class

D_2 = Difference between the frequency of the modal class and the class immediately succeeding the modal class.

i = size of the modal class interval

$$M_d = 10,000 + \left(\frac{95}{95 + 75} \right) \times 5,000$$

substitute the values

$$= 10000 + \left(\frac{95}{170} \right) = 5000 = 1000 + 2794 = 12794 \text{ Rs.}$$

Conclusion: Majority have the income of Rs 12794. This is how statistical techniques are used in MR application.

Median

Median lies precisely halfway between highest and lowest values. It is necessary to arrange the data into ascending or descending order before selecting the median value.

For ungrouped data with an odd number of observation, the median would be the middle value. For even number of observations, the median value is half way between central value.

For a grouped data median is calculated using the formula

$$M_d = LM_d \frac{\left(\frac{N}{2} - C.F\right)}{fM_d} \times i$$

M_d = Lower limit of median class

CF = Cumulative frequency for the class just below the median class.

fmd: Frequency of the median class.

i = Size of the class interval of median class.

In the table N = 300 N/2 = 150. The class containing the 150th person is the median class.

Substitute the value, we get median Md = 21568

Conclusion: Half of the population has income> 21568' and half of the population has income < 21568.

Mean

In a grouped data, the midpoint of each category would be multiplied by the number of observation in that category. Sum up and the total to be divided by the total number of observation.

$$\text{Eqn., } X = \sum\left(\frac{fx}{\sum f}\right)$$

Example: 2 students X, Y attend 3 classes tests and the scores areas follows:

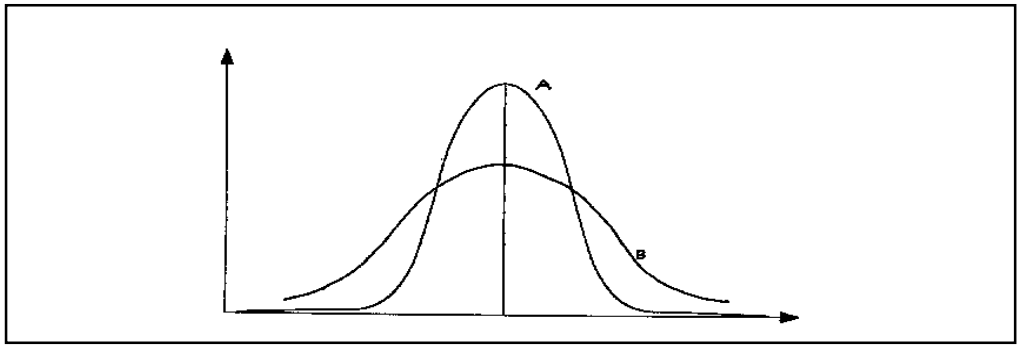
Though Mean is same, X is better than Y.

11.3.7 Measures of Dispersion

Introduction

Dispersion is the spread of the data in a distribution. A measure of dispersion

Marks		1st Test	2nd Test	3rd Test	Mean	
X		55%	60%	65%	60%	
Y		65%	60%	55%	60%	
Conclusion	X	- has improved				
	Y	- has Deteriorated				



Mean

Indicates the degrees of scattered ness of the observations. Let curves A and B represent two frequency distributions. Observe that A and B have the same mean. But curve A has less variability than B.

If we measure only the mean of these two distributions, we will miss an important difference between A and B. To increase our understanding of the pattern of the data we must also measure its dispersion.

Measures of Dispersion

Range: It is the difference between the highest and lowest observed values.

i.e. range = H – L, H = Highest, L = Lowest.

Note 1: Range is the crudest measure of dispersion.

2 : $\frac{H-L}{H+L}$ is called the coefficient of range.

Semi – Inter quartile Range (Quartile deviation) semi – Inter quartile range Q.

Q is given by $Q = \frac{Q_3 - Q_1}{2}$

Note 1: $\frac{Q_3 - Q_1}{Q_3 + Q_1}$ is called the coefficient of quartile deviation.

2: Quartile deviation is not a true measure of dispersion but only a distance of scale.

Mean Deviation (MD): If A is any average then mean deviation about A is given by

$$MD(A) = \frac{\sum f_i |x_i - A|}{N}$$

Note 1: Mean deviation about mean MD ($\bar{x}$) = $\frac{\sum f_i |x_i - \bar{x}|}{N}$

2: Of all the mean deviations taken about different averages mean derivation about the median is the least.

3: $\frac{MD(A)}{A}$ is called the coefficient of mean deviation.

Variance and Standard deviation

Variance (s^2) A measure of the average squared distance between the mean and each term in the population.

$$s^2 = \frac{1}{N}\sum f_i (x_i - \bar{x})^2$$

Standard deviation (s) is the positive square root of the variance

$$s = \sqrt{\frac{1}{N}\sum f_i (x_i - \bar{x})^2}$$

$$s^2 = \frac{1}{N}\sum f_i (x_i^2 - (\bar{x})^2$$

Note: Combined variance of two sets of data of N1 and N2 items with means x_1 and x_2 and standard deviations s_1 and s_2 respectively is obtained by

$$s^2 = \frac{N_1\sigma_1^2 + N_2\sigma_2^2 + N_1d_1^2 + N_1d_2^2}{N_1 + N_2}$$

Where $d_1^2 = (\bar{x} - \bar{x}_1)^2, d_2^2 = (\bar{x} - \bar{x}_2)^2$

and $\bar{x} = \frac{N_1\bar{x_1} + N_2\bar{x_2}}{N_1 + N_2}$

Sample variance (s^2) : Let $x_1, x_2, x_3, \ldots\ldots x_n$, represents a sample with mean $\bar{x}$

Then sample variance s^2 is given by

$$s^2 = \frac{\sum(x-\bar{x})^2}{n-1}$$

$$= \frac{\sum x^2}{n-1} - \frac{n(\bar{x})^2}{n-1}$$

Note: $s = \sqrt{\frac{\sum(x-\bar{x})^2}{n\text{-}1}} = \sqrt{\frac{\sum x^2}{n-1} - \frac{n(\bar{x})^2}{n-1}}$ is called the sample standard deviation.

Coefficient of variation (C.V)

It is a relative measure of dispersion that enables us to compare two distributions. It relates the standard deviation and the mean by expressing the standard deviation as a percentage of the mean.

$$\text{C.V.} = \frac{\sigma}{\bar{x}} \times 100$$

Note : 1. Coefficient of variation is independent of the unit of the observation.

2. This measure cannot be used when x is zero or close to zero.

Illustration 1: For the data

103, 50, 68, 110, 105, 108, 174, 103, 150, 200, 225, 350, 103 find the Range, Coefficient of range and coefficient of quartile deviation.

Solution : Range = H – L = 350 – 50 = 300

Coefficient of range $= \frac{H-L}{H+L} = \frac{300}{350+50} = 0.7$

To find Q_1 and Q_3 we arrange the data in ascending order

50, 68, 103, 103, 103, 103, 105, 108, 110, 150, 174, 200, 225, 350,

$\frac{n+1}{4} = \frac{14}{4} = 3.5,$

$\frac{3(n+1)}{4} = 10.5$

$\therefore Q_1 = 103 + 0.5\,(103 - 103) = 103$

$Q_3 = 174 + 0.5\,(200 - 174) = 187$

$$\text{Coefficient of QD} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

$$= \frac{84}{290} = 0.2896$$

Illustration 2: Calculate coefficient of mean deviation about

(i) Median (ii) mean from the following data

X	14	16	18	20	22	24	26
f	2	4	5	3	2	1	4

X	F	Cf	fx	$\lvert x - \bar{x} \rvert$	$\lvert x - M \rvert$	$f\lvert x - \bar{x} \rvert$	$f\lvert x - M \rvert$
14	2	2	28	5.71	4	11.42	8
16	4	6	64	3.71	2	14.84	8
18	5	11	90	1.71	0	8.55	0
20	3	14	60	0.29	2	0.87	6
22	2	16	44	2.29	4	4.58	8
24	1	17	24	4.29	6	4.29	6
26	4	21	104	6.29	8	25.16	32
	21		**414**			**69.71**	**68**

$$\bar{x} = \frac{\sum f_i x_i}{N} = \frac{414}{21} = 19.71$$

$$\frac{N+1}{2} = \frac{22}{2} = 11 \quad \therefore \text{Median } M = 18$$

$$\text{Now i) M.D } (\bar{x}) = \frac{\sum f_i \lvert x_i - \bar{x} \rvert}{N} = \frac{69.71}{21} = 3.32$$

$$\text{Coefficient of MD}(\bar{x}) = \frac{MD(\bar{x})}{\bar{x}} = \frac{3.32}{19.71} = 0.16$$

$$\text{ii) M.D (M)} = \frac{\sum f_i \lvert x_i - M \rvert}{N} = \frac{68}{21} = 3.24$$

$$\text{Coefficient of MD (M)} = \frac{MD(M)}{M} = \frac{3.24}{18} = 0.18$$

Illustration 3: A purchasing agent obtained a sample of incandescent lamps from two suppliers. He had the sample tested in his laboratory for length of life with following results.

Length of light In hours	**Sample A**	**Sample B**
700 – 900	10	3
900 – 1100	16	42
1100 – 1300	26	12
1300 – 1500	8	3

Which company's lamps are more uniform.

Solution: **Table 1**

Class interval	**Sample A**	**Midpoint x**	$u = \frac{x-1000}{200}$	fu	fu^2
700 – 900	10	800	- 1	- 10	10
900 – 1100	16	1000	0	0	0
1100 – 1300	26	1200	1	26	26
1300 – 1500	8	1400	2	16	32
	60			32	68

$\bar{u}_A = \frac{32}{60} = 0.533$

$\bar{x}_A = 1000 + 200$

$\therefore \bar{x}_A = 1000 + 200\,(0.533) = 1106.67$

$$s_u^2 = \frac{1}{N} = \sum fu^2 - (\bar{u}) = \frac{68}{60} - (0.533)^2$$

$= 1.133 - 0.2809$

$s_u^2 = 0.8524$

$s_u = 0.9233$

$s_x = 200 \times 0.9233 = 184.66$

$\therefore$ CV for sample A $= \frac{\sigma_A}{\bar{x}_A} \times 100$

$= \frac{184.66}{1106.67} \times 100 = 16.68\,\%$

Table 2

Class interval	**Sample B**	**Midpoint x**	$u = \frac{x-1000}{200}$	fu	fu^2
700 – 900	3	800	- 1	- 3	3
900 – 1100	42	1000	0	0	0
1100 – 1300	12	1200	1	12	12
1300 – 1500	3	1400	2	6	12
	60			15	27

$\bar{V} = \frac{15}{60} = 0.25$

$\bar{x}_B = 1000 + 200\,\bar{V}$

$= 1000 + 58$

$\therefore \bar{x}_B = 1058$

$$s_v^2 = \frac{1}{N} \sum fv^2 - (\bar{V})^2 = \frac{27}{60} - (0.25)^2$$

$$= 0.45 - 0.0625$$

$$s_v^2 = 0.3875$$

$$s_v = 0.6225$$

$$s_B = 200\ s_v$$

$$= 200 \times 0.6225$$

$$= 124.5$$

$$\text{C.V for Sample B} = \frac{\sigma_B}{\bar{X}_B} \times 100$$

$$\frac{124.5}{1058} \times 100 = 11.77\ \%$$

Since C,V. for sample B is smaller, sample B lamps are more uniform.

11.4 DATA ANALYSIS

Interpretation means bring out the meaning of data or we can say that interpretation is to convert data into information. The essence of any research is to draw conclusion about the study. This requires high degree of skill. There are 2 methods of drawing conclusions 1) induction 2) deduction.

In induction method, one starts from observed data and then generalization is done, which explains the relationship between objects observed.

On the other hand, deductive reasoning starts from some general law and then applied to a particular instance i.e., deduction comes from general to a particular situation.

Example of induction: All products manufactured by Sony are excellent. DVD player model 2602MX is made by Sony. Therefore it must be excellent.

Example of Deduction: All products have to reach decline stage one day and become obsolete. This Radio is in decline mode. Therefore it will become obsolescent.

During inductive phase, we reason from observation. During deductive phase, we reason towards observation. Both logic and observation are essential for interpretation.

Successful interpretation depends on 'How Well the data is analyzed'. If data is not properly analyzed, the interpretation may go wrong. If analysis has to be corrected, then data collection must be proper. Similarly if data collected is proper but analyzed wrongly, then also the interpretation or conclusion will be wrong. Sometimes even with proper data and proper analysis, can still lead to wrong interpretation. Interpretation depends on. Experience of the researcher and methods used by him for interpretation.

Example: A detergent manufacturer is trying to decide, which of the 3 sale promotion methods (Discount, contest, buy one get one free) would be most effective in increasing the sales. Each sales promotion method is run at different times in different cities. The sales got by the different sale promotion is a follows.

11.4.1 Sales Impact of Different Sale Promotion Methods

Sales Promotion Method	Sales Associated with Sales Promotion
1	2000
2	3500
3	2510

The results can conclude that the second Sales Promotion method was the most effective in developing sales. This may be adopted nationally to promote the product. But one cannot say that the same method of sales promotion will be effective in each and every city under study.

11.4.2 Precautions to be taken While Interpreting the Marketing Research Data

1) Keep the main objective of the research in mind.
2) Analysis of data should start from simpler and more fundamental aspects.
3) It should not be confusing.
4) Sample size should be adequate.
5) Take care before generalization of the sample studied.
6) Give due attention to significant questions.
7) Do not miss the significance of some answers, because they are found from a very few respondents, such as "don't know" or "can't say".

11.5 LET US SUM UP

Data when collected is raw in nature. When processed, it becomes information without data analysis, and interpretation, researcher cannot draw any conclusion. There are several steps in data processing such as editing, coding and tabulation. The main idea of editing is to eliminate errors. Editing can be done in the field or by sitting in the office. Coding is done to enter the data to the computer. In other words, coding speeds up tabulation. Tabulation refers to placing data into different categories. Tabulation may be one way, two way or cross tabulation. Several statistical tools such as mode, median, mean is used. Lastly interpretation of the data is required to bring out meaning or we can say data is converted into information. Interpretation can use either induction or deduction logic. While interpreting certain precautions are to be taken.

11.6 LESSON END ACTIVITY

A highway petrol police on NH_4want to find out how fast the car and the truck travels on this highway stretch. To obtain this information a speed recording device at an appropriate place on the highway was installed. The speed was recorded for about three hours and the following data was recorded:

Speed in miles/hr.

73	49	70	63
55	61	60	68
52	50	69	60
65	66	59	62

Calculate the appropriate statistics for central tendency and dispersion.

11.7 KEYWORDS

Editing

Coding

Tabulation

Field editing

Office editing

Mode

Median

Mean

Dispersion

11.8 QUESTIONS FOR DISCUSSION

1. What is data processing?
2. What are the steps in data processing?
3. What is editing?
4. What are the stages of editing?
5. What is coding? What are the guidelines to codify the data?
6. What is tabulation?
7. What are the different kinds of tabulation?
8. How to summarise & classify the collected data?
9. Explain the following:
   (a) Mode (b) Median (c) Mean
10. What is measure of dispersion?
11. Explain the following:
    (a) Mean Deviation (b) Variance & Standard deviation
    (c) Coefficient of variation
12. Explain: How to interpret the collected data?
13. Explain Induction & Deduction with examples.
14. What are the precautions to be taken while interpreting marketing research data?
15. Discuss sampling and non-sampling methods
16. What are sampling and non-sampling errors?
17. What are statistical estimates?
18. What are point and interval estimates?
19. How to calculate the interval estimate of the mean from large samples?
20. How to calculate the interval estimate of the proportion when–
    (a) Population portion is unknown
    (b) Using T distribution

11.9 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases"*, All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision-making"*, Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology - Methods and Techniques", Wiley* Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics"*, D.B. Taraporevala Sons and Co. Private Limited, Bombay.

UNIT-IV

LESSON

12

TEST OF SIGNIFICANCE

CONTENTS

12.0 AIMS AND OBJECTIVES

In this lesson we will study to decide level of significance, one-tailed and two-tailed test, parametric test and application of SPSS. After studying this lesson you will be able to:

(i) know assumptions, advantages and disadvantages of parametric and non-parametric test.

(ii) describe T-test and F-test.

(iii) Analyse ANOVA.

(iv) understand SPSS and its applications.

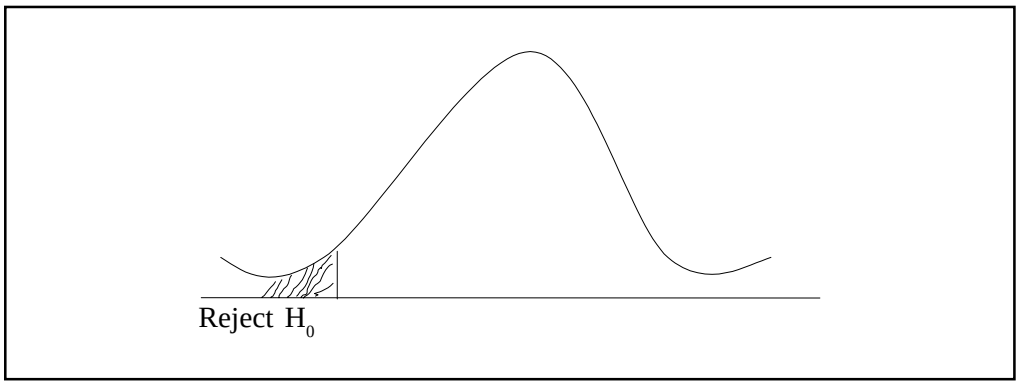
12.1 INTRODUCTION

Having formulated the hypothesis, the next step is its validity at a certain level of significance. The confidence with which a null hypothesis is accepted or rejected depends upon the significance level. A significance level of say 5% means that the risk of making a wrong decision is 5%. The researcher is likely to be wrong in accepting false hypothesis or rejecting a true hypothesis by 5 out of 100 occasions. A significance level of say 1% means, that the researcher is running the risk of being wrong in accepting or rejecting the hypothesis is one of every 100 occasions. Therefore, a 1% significance level provides greater confidence to the decision than 5% significance level.

There are two type of tests.

One-tailed and two-tailed tests

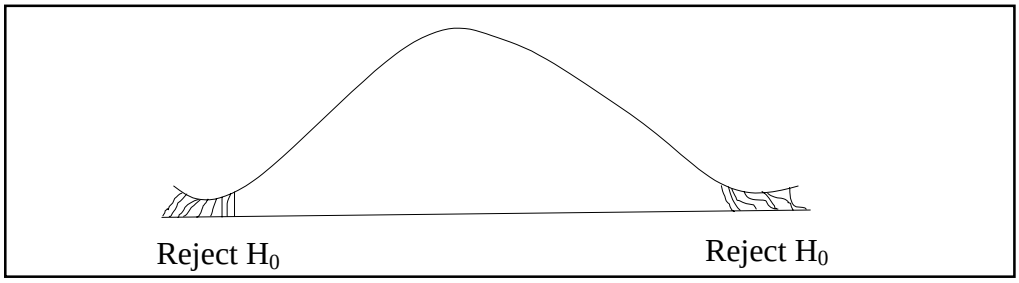
A hypothesis test may be one-tailed or two-tailed. In one-tailed test the test-statistic for rejection of null hypothesis falls only in one-tailed of sampling distribution curve.



Example 1: In a right side test, the critical region lies entirely in the right tail of the sample distribution. Whether the test is one-sided or two-sided - depends on alternate hypothesis.

Example 2: A tyre company claims that mean life of its new tyre is 15,000 km. Now the researcher formulates the hypothesis that tyre life is = 15,000 km.

A two-tailed test is one in which the test statistics leading to rejection of null hypothesis falls on both tails of the sampling distribution curve as shown.



When we should apply a hypothesis test that is one-tailed or two-tailed depends on the nature of the problem. One-tailed test is used when the researcher's interest is primarily on one side of the issue. Example: "Is the current advertisement less effective than the proposed new advertisement"?

A two-tailed test is appropriate, when the researcher has no reason to focus on one side of the issue. Example: "Are the two markets - Mumbai and Delhi different to test market a product?"

Example: A product is manufactured by a semi-automatic machine. Now, assume that the same product is manufactured by the fully automatic machine. This will be two-sided

test, because the null hypothesis is that "the two methods used for manufacturing the product do not differ significantly".

$\therefore H_0 = \mu_1 = \mu_2$

Sign of alternate hypothesis	Type of test
=	Two-sided
<	One-sided to right
>	One-sided to left

12.1.1 Degree of Freedom

It tells the researcher the number of elements that can be chosen freely. Example: a+b/2 =5. fix a=3, b has to be 7. Therefore, the degree of freedom is 1.

Select test criteria

If the hypothesis pertains to a larger sample (30 or more), the Z-test is used. When the sample is small (less than 30), the T-test is used.

Compute

Carry out computation.

12.1.2 Make Decisions

Accepting or rejecting of the null hypothesis depends on whether the computed value falls in the region of rejection at a given level of significance.

12.2 ASSUMPTIONS ABOUT PARAMETRIC AND NON-PARAMETRIC TEST

i. Observations in the population are normally distributed.

ii. Observations in the population are independent to each other.

iii. Population should posses' homogeneous characteristics.

iv. Samples should be drawn using simple random sampling techniques.

v. To use T test sample size should be less than 30.

vi. To use F test sample size should be less than 30.

vii. To use Z test sample size should be more than 30.

viii. To use chi square minimum number of observation should be five.

12.2.1 Parametric Test

1) Parametric tests are more powerful. The data in this test is derived from interval and ratio measurement.

2) In parametric tests, it is assumed that the data follows normal distributions. Examples of parametric tests are (a) Z-Test, (b) T-Test and (c) F-Test.

3) Observations must be independent i.e., selection of any one item should not affect the chances of selecting any others be included in the sample.

12.2.2 Non-parametric Test

Non-parametric tests are used to test the hypothesis with nominal and ordinal data.

(1) We do not make assumptions about the shape of population distribution.

(2) These are distribution-free tests.

(3) The hypothesis of non-parametric test is concerned with something other than the value of a population parameter.

(4) Easy to compute. There are certain situations particularly in marketing research, where the assumptions of parametric tests are not valid. Example: In a parametric test, we assume that data collected follows a normal distribution. In such cases, non-parametric tests are used. Example of non-parametric tests are (a) Binomial test (b) Chi-Square test (c) Mann-Whitney U test (d) Sign test. A binominal test is used when the population has only two classes such as male, female; buyers, non-buyers, success, failure etc. All observations made about the population must fall into one of the two tests. The binomial test is used when the sample size is small.

Advantages

1. They are quick and easy to use.
2. When data are not very accurate, these tests produce fairly good results.

Disadvantages

Non-parametric test involves the greater risk of accepting a false hypothesis and thus committing a Type 2 error.

Details of non-parametric tests are given in the next lesson.

12.3 PARAMETRIC TESTS

12.3.1 T-test (Parametric test)

T-test is used in the following circumstances: When the sample size n<30.

Example: A certain pesticide is packed into bags by a machine. A random sample of 10 bags are drawn and their contents are found as follows: 50,49,52,44,45,48,46,45,49,45. Confirm whether the average packaging can be taken to be 50 kgs.

In this text, the sample size is less than 30. Standard deviations are not known using this test. We can find out if there is any significant difference between the two means i.e. whether the two population means are equal.

Illustration: There are two nourishment programmes 'A' and 'B'. Two groups of children are subjected to this. Their weight is measured after six months. The first group of children subjected to the programme 'A' weighed 44,37,48,60,41 kgs. at the end of programme. The second group of children were subjected to nourishment programme 'B' and their weight was 42, 42, 58, 64, 64, 67, 62 kgs. at the end of the programme. From the above, can we conclude that nourishment programme 'B' increased the weight of the children significantly, given a 5% level of confidence.

12.3.2 Null Hypothesis

There is no significant difference between Nourishment programme 'A' and 'B'.

12.3.3 Alternative Hypothesis

Nourishment programme B is better than 'A' or Nourishment programme 'B' increase the children's weight significantly.

Solution:

	Nourishment programme A			**Nourishment programme B**	
X	$x-\bar{x}$ = (x-46)	$(x-\bar{x})^2$	Y	$y-\bar{y}$ =(y-57)	$(y-\bar{y})^2$
44	-2	4	42	-15	225
37	-9	81	42	-15	225
48	2	4	58	1	1
60	14	196	64	7	49
41	-5	25	64	7	49
			67	10	100
			62	5	25
230	**0**	**310**	**399**	**0**	**674**

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Here $n_1 = 5 \qquad n_1 = 7$

$\sum x = 230 \qquad \sum y = 399$

$\sum\left(x - \bar{x}\right)^2 = 310 \qquad \sum\left(y - \bar{y}\right)^2 = 674$

$$\bar{x} = \frac{\sum x}{n_1} = \frac{230}{5} = 46$$

$$\bar{y} = \frac{\sum y}{n_2} = \frac{399}{7} = 57$$

$$s^2 = \frac{1}{n_1 + n_2 - 2}\left\{\sum\left(x - \bar{x}\right)^2 + \sum\left(y - \bar{y}\right)^2\right\}$$

D.F = $(n_1+n_2-2) = (5+7-2) = 10$

$$s^2 = \frac{1}{10}\{310 + 674\} = 98.4$$

$$t = \frac{46 - 57}{\sqrt{98.4 \times \left(\frac{1}{5} + \frac{1}{7}\right)}}$$

$$= \frac{-11}{\sqrt{98.4 \times \left(\frac{12}{35}\right)}}$$

$$= \frac{-11}{\sqrt{33.73}} = -\frac{11}{5.8}$$

$= -1.89$

t at 10 d.f. at 5% level is 1.81.

Since, calculated t is greater than 1.81, it is significant. Hence HA is accepted. Therefore the two nutrition programmes differ significantly with respect to weight increase.

Application of SPSS

1. Open a new spread sheet. Enter the weight of children in first column. First, enter the weight of children in Group "A" in the first five cells and then the weight of children in Group "B" in the next 7 cells.
2. In the second column, type a "1" next to each weight of children in group 'A'. Type a '2' next to each weight of children in Group 'B'.
3. Highlight the heading "Analyse" and go to "Compare means". Then click on "Independent sample T-test".

4. Under "Grouping variable" click "Define groups". For "Group 1" type "1" and for "Group 2" type "2". This will indicate the Groups (A and B) weights of the 2 groups will be compared.

Click on "Continue" and "OK". The output will appear on the screen.

12.4 F TEST

12.4.1 Analysis of Variance (ANOVA)

(a) ***ANOVA:*** It is a statistical technique. It is used to test the equality of three or more sample means. Based on the means, inference is drawn whether samples belongs to same population or not.

(b) Conditions for using ANOVA:

(1) Data should be quantitative in nature.

(2) Data normally distributed.

(3) Samples drawn from a population follows random variation.

(c) ANOVA can be discussed in two parts :

(1) One-way classification

(2) Two and three-way classification.

12.4.2 One-way ANOVA

Following are the steps followed in ANOVA:

(a) Calculate the variance between samples.

(b) Calculate the variance within samples.

(c) Calculate F ratio using the formula.

F= Variance between the samples / Variance within the sample

(d) Compare the value of F obtained above in (c) with the critical value of F such as 5% level of significance for the applicable degree of freedom.

(e) When the calculated value of F is less than the table value of F, the difference in sample means is not significant and a null hypothesis is accepted. On the other hand, when the calculated value of F is more than the critical value of F, the difference in sample means is considered as significant and the null hypothesis is rejected.

Example

ANOVA is useful.

(1) To compare the mileage achieved by different brands of automotive fuel.

(2) Compare the first year earnings of graduates of half a dozen top business schools.

Application in Market Research

Consider the following pricing experiment. Three prices are considered for a new toffee box introduced by Nutrine company. Price of three varieties of toffee boxes are Rs. 39, Rs. 44 and Rs. 49. The idea is to determine the influence of price levels on sales. Five supermarkets are selected to exhibit these toffee boxes. The sales are as follows:

Price (Rs.)	1	2	3	4	5	Total	Sample mean $\bar{X}$
39	8	12	10	9	11	50	10
44	7	10	6	8	9	40	8
49	4	8	7	9	7	35	7

What the manufacturer wants to know is: (1) Whether the difference among the means is significant? If the difference is not significant, then the sale must be due to chance. (2) Do the means differ? (3) Can we conclude that the three samples are drawn from the same population or not?

12.4.3 Two-way ANOVA

The procedure to be followed to calculate variance is the same as it is for the one-way classification. The example of two-way classification of ANOVA is as follows:

Example: A firm has four types of machines - A , B, C and D. It has put four of its workers on each machines for a specified period, say one week. At the end of one week, the average output of each worker on each type of machine was calculated. These data are given below:

	Average production by the type of machine			
	A	**B**	**C**	**D**
Worker 1	25	26	23	28
Worker 2	23	22	24	27
Worker 3	27	30	26	32
Worker 4	29	34	27	33

The firm is interested in knowing:

(a) Whether the mean productivity of workers is significantly different.

(b) Whether there is a significant difference in the mean productivity of different types of machines.

Illustration: Company 'X' wants its employees to undergo three different types of training programme with a view to obtain improved productivity from them. After the completion of the training programme, 16 new employees are assigned at random to three training methods and the production performance were recorded.

The training managers problem is to find out if there are any differences in the effectiveness of the training methods? The data recorded is as under:

Daily output of new employees

Method 1	15	18	19	22	11	
Method 2	22	27	18	21	17	
Method 3	18	24	19	16	22	15

Following steps are followed.

1. Calculate Sample mean i.e. $\bar{x}$

2. Calculate General mean i.e. $\bar{x}$

3. Calculate variance between columns using the formula $\bar{\sigma}^2 = \frac{\sum n_i \left(x_i - \bar{\bar{x}}\right)^2}{k-1}$ where K = $(n_1+n_2+n_3-3)$.

4. Calculate sample variance. It is calculated using formula:

   Sample variance $s_i^2 = \frac{\sum \left(x_i - \bar{x}\right)^2}{n-1}$ where *n* is No. of observation under each method.

5. Calculate variance within columns using the formula $\bar{\sigma}^2 = \frac{\sum n_i - 1}{n_r - k}$

6. Calculate F using the ratio F = $\left(\frac{\text{between column variance}}{\text{within column variance}}\right)$

7. Calculate the number of degree of freedom in the numerator F ratio using equation, d.f=(No. of samples -1).

8. Calculate the number of degree of freedom in the denominator of F ratio using the equation d.f= $\sum\left(n_i - k\right)$

9. Refer to F table f8 find value.

10. Draw conclusions.

Solution

Method 1	Method 2	Method 3
15	22	24
18	27	19
19	18	16
22	21	22
11	17	15
		18
85	**105**	**114**

1. Sample mean is calculated as follows:

$$\bar{x}_1 = \frac{85}{5} = 17 \quad \bar{x}_2 = \frac{105}{5} = 21 \quad \bar{x}_3 = \frac{114}{6} = 19$$

2. Grand mean

$$= \bar{\bar{x}} = \frac{15+18+19+22+11+22+27+18+21+17+24+19+16+22+15+18}{16}$$

$$= \frac{304}{16} = 19$$

3. Calculate variance between columns:

N	$\bar{x}$	$\bar{\bar{x}}$	$\bar{x} - \bar{\bar{x}}$	$\left(\bar{x} - \bar{\bar{x}}\right)^2$	$n\left(\bar{x} - \bar{\bar{x}}\right)^2$
5	17	19	-2	4	5 × 4 = 20
5	21	19	2	4	5 × 4 = 20
6	19	19	0	0	6 × 0 = 0
				$\sum n_i\left(\bar{x}_1 - \bar{\bar{x}}\right)^2$	= 40

$$\bar{\sigma}^2 = \frac{\sum n_i \left(x_i - \bar{\bar{x}}\right)^2}{k-1} = \frac{40}{3-1} = 20$$

Variance between column = 20

Training method -1		Training method -2		Training method -3	
$x-\bar{x}$	$(x-\bar{x})^2$	$x-\bar{x}$	$(x-\bar{x})^2$	$x-\bar{x}$	
15-17	$(-2)^2 = 4$	22-21	$(1)^2 = 1$	18-19	$(1)^2 = 1$
18-17	$(1)^2 = 1$	27-21	$(6)^2 = 36$	24-19	$(5)^2 = 25$
19-17	$(2)^2 = 4$	18-21	$(-3)^2 = 9$	19-19	$(0)^2 = 0$
22-17	$(5)^2 = 25$	21-21	$(0)^2 = 1$	16-19	$(-3)^2 = 9$
11-17	$(-6)^2 = 36$	17-21	$(-4)^2 = 16$	22-19	$(3)^2 = 9$
				15-19	$(-4)^2 = 16$
$\sum(x-\bar{x})^2 = 70$		$\sum(x-\bar{x})^2 = 62$			$\sum(x-\bar{x})^2 = 60$

4. Sample variance = $\frac{\sum(x-\bar{x})^2}{n-1} = \frac{70}{5-1}$ $\frac{\sum(x-\bar{x})^2}{n-1} = \frac{62}{5-1}$ $\frac{\sum(x-\bar{x})^2}{n-1} = \frac{60}{6-1}$

$s_1^2 = \frac{70}{4} = 17.5$, $s_2^2 = \frac{62}{4} = 15.5$, $s_3^2 = \frac{60}{5} = 12$

5. Within column variance $\bar{\sigma}^2 = \Sigma \left(\frac{n_i - 1}{n_i - k}\right) s_1^2$

$$\left(\frac{5-1}{16-3}\right)\times 17.5 + \left(\frac{5-1}{16-3}\right)\times 15.5 + \left(\frac{6-1}{16-3}\right)\times 12$$

$$= \left(\frac{4}{13}\right)\times 17.5 + \left(\frac{4}{13}\right)\times 15.5 + \frac{5}{13}\times 12$$

Within column variance $= \frac{192}{13} = 14.76$

6. F = $\frac{\text{Between column variance}}{\text{Within column variance}} = \frac{20}{14.76} = 1.354$

7. d.f of Numerator = (3 – 1) = 2.

8. d.f of Denominator = $\Sigma n_1 - k$

= (5 - 1) + (5 - 1) + (6 - 1) = 16 - 3 = 13.

9. Refer to table using d.f = 2 and d.f = 13.

10. The value is 3.81. This is the upper limit of acceptance region. Since calculated value 1.354 lies within it we can accept H0, the null hypothesis.

Conclusion: There is no significant difference in the effect of the three training methods.

Check Your Progress

1. Out of 1% significance level and 5% significance level, which one provide greater confidence? Justify your answer.
2. When two population are involved then, which test is better to use? Justify your answer.

12.5 SPSS AND ITS APPLICATIONS

1. Open a new spread sheet (SPSS).
2. Enter the data in the first column grouped according to training method i.e. enter 15,18,19,22,11,22,27 and so on till 16 numbers are in the first 16 cells. Then, in the second column enter a '1' next to production performance figures of trainees, by method No. 1. Enter a '2' next to production performance figures of trainees, by method No. 2.

   Finally enter a '3' next to product performance figures of trainees by method No. 3. This tells the computer which number belongs to the designated group. i.e. the '1' next to cells containing 15,18,19,22,11 indicates these numbers belong to first group, which in this case is method 1 of training programme. The same thing applies to '2' and '3'.
3. At the top of the first column double click on "var0001". Under "Name" type "Method" in place of "var0001". Then click on "var00002" and type Prod Perf. (cell limited to eight letters hence abbreviation). Then at the bottom of the spread sheet, click on "Data view" tab. This exercise will name the categories.
4. At the top of the spread sheet click on "Analyze". Then click on "Compare Means" and "one-way ANOVA". This commands indicate the statistical test to be run.
5. Using arrows shift "Prod Perf" over to "Dependent list" and shift training to "Factor". This show that Prod Perf is the dependent variable and training is the independent variable to be examined.
6. Then click O.K.
7. The SPSS output will appear.

Z test (Parametric test)

a) When sample size is > 30

P_1 = Proportion in sample 1

P_2 = Proportion in sample 2

Example: You are working as a purchase manager for a company. The following information has been supplied by two scooter tyres manufacturers.

	Company A	**Company B**
Mean life (in km)	13000	12000
S.D (in km)	340	388
Sample size	100	100

In the above, the sample size is 100, hence a Z-test may be used.

b) Testing the hypothesis about difference between two means: This can be used when two population means are given and null hypothesis is $H_o : P_1 = P_2$.

Illustration

In a city during the year 2000, 20% of households indicated that they read 'Femina' magazine. Three years later, the publisher had reasons to believe that circulation has gone up. A survey was conducted to confirm this. A sample of 1,000 respondents were contacted and it was found 210 respondents confirmed that they subscribe to the periodical 'Femina'. From the above, can we conclude that there is a significant increase in the circulation of 'Femina'?

Solution:

We will set up null hypothesis and alternate hypothesis as follows:

Null Hypothesis is H_0. $\mu = 15\%$

Alternate Hypothesis is H_A. $\mu > 15\%$

This is a one-tailed (right) test.

$$Z = \frac{P - \mu}{\sqrt{\frac{\mu(1-\mu)}{n}}}$$

$$Z = \frac{\frac{210}{1000} - 0.20}{\sqrt{\frac{0.20(1-0.20)}{1000}}}$$

$$Z = \frac{0.21 - 0.20}{\sqrt{\frac{0.2 \times 0.8}{1000}}}$$

$$= \frac{0.01 - \mu}{\sqrt{\frac{0.16}{1000}}}$$

$$= \frac{0.1}{\frac{0.4}{31.62}}$$

$$= \frac{0.1}{0.012} = 8.33$$

As the value of Z at 0.05 =1.64 and calculated value of Z falls in the rejection region, we reject null hypothesis, and therefore we conclude that the sale of 'Femina' has increased significantly.

12.6 LET US SUM UP

Hypothesis is a proposition which the researcher wants to verify. There are two types of hypothesis, descriptive and relationship, there are several types of hypothesis such as theory, observation, past experience and case studies. There are several characteristics of the hypothesis, which decides whether a hypothesis is good or bad. Researcher will form two hypothesis (a) Null hypothesis (b) Alternative hypothesis, for accepting or rejecting the statement. There are two types of tests one tailed test or two tailed test. Two types of error may occur while testing hypothesis (a) Hypothesis is rejected when it is true (b) Hypothesis not rejected when it is false former is known as types error and later is known as type 2 error.

There are 2 types of statistical test parametric test and parametric test. In parametric test distribution is considered as normal. Non parametric tests are easy to use. In data analysis researcher may wish to analyse one or more variable at a time. Z test, T tests are examples of parametric tests. Based on the size of sample more than 30 or less than 30, appropriate tests are chosen chi square, cox and stuart test, Mann whitney tests are examples of non parametric test. Rank sum test is used when more than two population is involved. Goodness of fit is examined by kolmogorw smirnov test.

12.7 LESSON-END ACTIVITY

What hypothesis, test and procedure would you use in the following situation?

A company has 22 sales executives. They underwent a training programme. The test must evaluate whether the sales performance is unchanged or improved after the training programme.

12.8 KEYWORDS

Hypothesis

Univariate statistic

Bivariate statistic

Ch-square test

Degree of freedom

F- statistic

12.9 QUESTIONS FOR DISCUSSION

1. What is Hypothesis?
2. What is null hypothesis and alternate hypothesis?
3. Distinguish between: Theory and Hypothesis?
4. Explain briefly various types of hypothesis.
5. Explain the various sources from which hypothesis are derived?
6. What are the characteristics of hypothesis? Explain each one in detail.
7. What are the various steps used to test hypothesis?
8. What is a one tailed and two tailed test?
9. When is two tailed test preferred to one tail test?
10. What is type I & type II error? Give examples.
11. What is null Hypothesis & alternate Hypothesis?
12. Differentiate univariate Hypothesis from multivariate Hypothesis tests.
13. Distinguish parametric & non parametric test.
14. What is meant by (a) Significance level (b) Degree of freedom?
15. What are univariate and bivariate analysis?
16. What are Z-test and T-test and, when each one is suitable?

12.10 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases",* All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision making",* Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology- Methods and Techniques", Wiley* Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics",* D.B. Taraporevala Sons and Co. Private Limited, Bombay.

LESSON

13

NON-PARAMETRIC TESTS

CONTENTS

13.0 AIMS AND OBJECTIVES

This lesson is intended to discuss non-parametric tests for hypothesis testing. After studying this lesson you will be able to:

(i) determine whether two independent samples have been drawn from the same population.

(ii) analyse Kruskal-Wallis test for more than two population.

(iii) identify the pairs and decide whether the pairs have more or less similar characteristic by using sign-test.

13.1 INTRODUCTION

As we have seen in the previous lesson that f-test may not be applicable in all cases of analysing data of two related samples. In such cases for analysing the data, we may use non-parametric statistical tests of two related samples. There are three most commonly used methods for two related samples, which are discussed below.

13.2 "U" TESTS

(Rank Sum test)

This test is used to determine whether two independent samples have been drawn from the same population. Suppose an experiment has obtained two sets of samples from two populations and the study wishes to examine whether the two populations are identical.

Example: A computer company XYZ would like to choose the performance of programmers, working in 2 branches, located in different cities. The performance indices of employees:

Branch – A	Branch – B
84	76
68	77
78	64
49	62
45	53

To find out whether there is any difference in the performance indices of employees of the two branches.

13.3 COX AND STUART TEST

This test is used to examine the presence of trends. A set of numbers is said to show upward trend if the latter numbers in the sequence are greater than the former numbers. And similarly, one can define a downward trend. How to examine whether a trend is noticeable in a sequence? Example: Suppose a marketer wants to examine whether its sales are showing a trend or just fluctuating randomly. Suppose the company has gathered the monthly sales figures during the past one year month-wise:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Sales	200	250	280	300	320	278	349	268	240	318	220	380

From the given data, analyse the sales trend.

13.4 KRUSKAL-WALLIS TEST

We can use the Mann Whitney test; when two populations are involved, the Kruskal-Wallis test is used, when more than two populations are involved. This test will enable us to know whether independent samples have been drawn from the same population or from different populations having the same distribution. This test is an extension of "Mann Whitney test".

This is a type of Rank Sum test. This test is used to find out whether two or more independent samples are drawn from an identical population. This test is also called the H Test. Mann Whitney test is used when only two populations are involved and Kruskal-Wallis test is used when more than two populations are involved.

Example: In an assembling unit, three different workers do assembly work in shifts. The data is tabulated as follows:

Shift No.	Worker-1	Worker-2	Worker-3
1	**25**	**28**	**29**
2	31	28	30
3	35	29	27
4	33	28	36
5	35	32	31
6	31	32	34

Check whether there is any difference in the production quantum of the three workers:

Illustration: (Kruskal-Wallis Test, H-Test)

Let us assume that there are three categories of workers involved in a building construction. The wages depends on the skills possessed by them and their availability. The wages of three categories, namely painter carpenter and plumber are as follows:

Item	Sample 1	Sample 2	Sample 3
	Daily wages (Painter Rs.)	Daily wages (Carpenter Rs.)	Daily wages (Plumber Rs.)
1	64	72	51
2	66	74	52
3	72	75	54
4	74	78	56
5		80	

Item	Wage-Painter Rs./day		Wage-Carpenter Rs./day		Wage-Plumber Rs./day	
	Rs	Rank	Rs	Rank	Rs	Rank
1	64	5	72	7.5	51	1
2	66	6	74	9.5	52	2
3	72	7.5	75	11	54	3
4	74	9.5	78	12	56	4
5			80	13		
Total	276	R_1=28	379	R_2=53	213	R_3=10

Use H-test and state whether the three populations are same or different.

H_0 - The wages of the three occupation are the same.

H_1 - The wages of the three occupations is not the same.

n_1= 4 n_2=5 n_3=4

$n = n_1 + n_2\, n_3 = 4+5+4 = 13$

R_1=28 R_2= 53 R_3 = 10

$$H = \frac{12}{n(n+1)} \sum \left[\frac{R_1^2}{n_1} \right] - 3(n+1)$$

$$H = \frac{12}{13(13+1)} \sum \left[\frac{28^2}{4} + \frac{53^2}{5} + \frac{10^2}{4} \right] - 3(3+1) = 9.61$$

At 5% level of significance, for d.f = (3-1)=2, the table value is 5.991. Computed value 9.61 is greater.

Conclusion: Reject the Null hypothesis that the three populations are different.

Application of SPSS

1. Open a new spread sheet.
2. Type the first group of numbers in the first column and the second group of numbers in the second column.
3. Using the headings of the page and click "Analyse".
4. Click on "Non parametric Tests" and then click on "2" related sample test.
5. Add "Test type" click on "Kruskal".
6. Then shift "var0001" "and var0002" over to "Test pairs list".
7. Click on OK.

   The output will appear on the screen.

13.5 KOLMOGOROV-SMIRNOV TEST

This is used for examining the efficacy of fit between observed samples and expected frequency distribution of data when the variable is in the ordinal scale.

Example:

A manufacturer of cosmetics wants to test four different shades of the liquid foundation compound - very light, light, medium and dark. The company has hired a market research agency to determine whether any distinct preference exists towards either extremes. If so, the company will manufacture only the preferred shade, otherwise, the company is planning to market all shades. Suppose, out of a sample of hundred, 50 preferred "very light shade" 30 liked light shade, 15 the medium shade, and 50 dark shade. Do you think the results show any kind of preference?

Since the shade represents ordering (rank), this test can be used to find the preference.

13.6 RUN-TEST FOR RANDOMNESS

Consider the example of arrival of customers at a branch office of a telephone department for payment of telephone bills after the due date. The senior officer of the telephone department wants to verify whether the gender of arriving customer is random.

Example: Sequence of arriving customers is as shown below. M is Male F is Female.

MM FFF MMM FFF M F MMMM FF

No. of male = 10

No. of female = 9

No. of run = 8

13.7 SIGN-TEST

Sign-test is used with matched pairs. The test is used to identify the pairs and decide whether the pair has more or less similar characteristics.

Example: Suppose, an experiment on the effect of brand name on quality perceptions is to be conducted. 10 persons are selected and asked to taste and compare the two products (beverage). One of them is identified as branded well known beverage, and the other is a new beverage. In reality, the samples are identical. The respondents who tested were asked to rate the two samples on an ordinal scale. Two hypotheses are set up as follows:

H_0 - there is no difference between the perceived qualities of two beverages.

H_A - there is a difference in the perceived qualities of two beverages.

Check Your Progress

Discuss the uses of non-parametric test in hypothesis testing.

13.8 LET US SUM UP

We have discussed various non-parametric tests for hypothesis testing. U-test, i.e., rank sum test, is used to determine whether two independent sample have been drawn from the same population. Kruskal-Wallis test, which is an extension of Mann Whitney test, is used when more than two populations are involved. We have also discussed Sign-Test for matched pairs.

13.9 LESSON-END ACTIVITY

A company has three categories of managers:

1. With professional qualifications but without work experience.
2. With professional qualifications accompanied by work experience.
3. Without professional qualifications but with work experience.

A study was conducted to measure the motivation level of each of the category of managers. Formulate a hypothesis, suggesting testing procedures to show that there is no relation between the category of managers and the level of motivation.

13.10 KEYWORDS

Non-parametric test

Related Samples

Matching pair

Rank-sum Test

Rank correlation Test

Krustal-Wallis test

Rank sum

Multi variate analysis

Parametric test

Non parametric test

Type I error

Variable

Variance

Z-test

T-test

Mann Whitney

"U" test

Cox & Stuart test

13.11 QUESTIONS FOR DISCUSSION

1. What is cox and stuart test?
2. What is Rank sum Test?
3. Give an example of Kruskal-Wallis test.
4. Write a brief note on application of SPSS in non-parametric Test.
5. Explain run test for randomness

13.12 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases",* All India Traveller Bookseller, New Delhi.

Brown, F.E. *"Marketing Research, a structure for decision making",* Addison- Wesley Publishing Company.

Kothari, C.R. *"Research Methodology- Methods and Techniques",* Wiley Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics",* D.B. Taraporevala Sons and Co. Private Limited, Bombay.

LESSON
14

MULTIVARIATE ANALYSIS

CONTENTS

14.0 AIMS AND OBJECTIVES

In this lesson we will study bivariate and multivariate analysis and their applications in business research. After studying this lesson you will be able to:

(i) understand the concept of bivariate and multivariate analysis.

(ii) describe five types of analysis under multivariate analysis.

(iii) use SPSS in multivariate analysis.

14.1 INTRODUCTION

In multivariate analysis, the number of variables to be tackled are many.

Example: The demand for television sets may depend not only on price, but also on the income of households, advertising expenditure incurred by TV manufacturer and other similar factors. To solve this type of problem, multivariate analysis is required.

Multiple-variate analysis: This can be studied under:

(1) Discriminant analysis

(2) Factor analysis

(3) Cluster analysis

(4) Conjoint analysis

(5) Multidimensional scaling.

14.2 FACTOR ANALYSIS

The main purpose of Factor Analysis is to group large set of variable factors into fewer factors. Each factor will account for one or more component. Each factor a combination of many variables. There are two most commonly employed factor analysis procedures. They are:

(1) Principle component analysis

(2) Common factor analysis.

When the objective is to summarise information from a large set of variables into fewer factors, principle component factor analysis is used. On the other hand, if the researcher wants to analyse the components of the main factor, common factor analysis is used.

Example: Common factor - Inconvenience inside a car. The components may be:

1. Leg room.
2. Seat arrangement.
3. Entering the rare seat.
4. Inadequate dickey space.
5. Door locking mechanism.

Principle Component Factor Analysis

Purposes: Customer feedback about a two-wheeler manufactured by a company.

Method: The M.R manager prepares a questionnaire to study the customer feedback. The researcher has identified six variables or factors for this purpose. They are as follows:

1. Fuel efficiency (A)
2. Durability (Life) (B)
3. Comfort (C)
4. Spare parts availability (D)
5. Breakdown frequency (E)
6. Price (F)

The questionnaire may be administered to 5,000 respondents. The opinion of the customer is gathered. Let us allot points 1 to 10 for the variables factors A to F. 1 is the lowest and 10 is the highest. Let us assume that application of factor analysis has led to grouping the variables as follows:

A, B, D, E into factor - 1

F into Factor -2

C into Factor - 3

Factor - 1 can be termed as Technical factor;

Factor - 2 can be termed as Price factor;

Factor - 3 can be termed as Personal factor.

For future analysis, while conducting a study to obtain customers' opinion, three factors mentioned above would be sufficient. One basic purpose of using factor analysis is to reduce the number of independent variables in the study. By having too many independent variables, the M.R study will suffer from following disadvantages:

1. Time for data collection is very high due to several independent variables.
2. Expenditure increases due to the time factor.
3. Computation time is more, resulting in delay.
4. There may be redundant independent variables.

14.3 CLUSTER ANALYSIS

Cluster Analysis is used:

1. To classify persons or objects into small number of clusters or group.
2. To identify specific customer segment for the company's brand.

Cluster Analysis is a technique used for classifying objects into groups. This can be used to sort data (a number of people, companies, cities, brands or any other objects) into homogeneous groups based on their characteristics.

The result of Cluster Analysis is a grouping of the data into groups called clusters. The researcher can analyse the clusters for their characteristics and give the cluster, names based on these.

Where can Cluster Analysis be applied?

The marketing application of cluster analysis is in customer segmentation and estimation of segment sizes. Industries, where this technique is useful include automobiles, retail stores, insurance, B-to-B, durables and packaged goods. Some of the well-known frameworks in consumer behaviour (like VALS) are based on value cluster analysis.

Cluster Analysis is applicable when:

- An FMCG company wants to map the profile of its target audience in terms of lifestyle, attitude and perceptions.
- A consumer durable company wants to know the features and services a consumer takes into account, when purchasing through catalogues.
- A housing finance corporation wants to identify and cluster the basic characteristics, lifestyles and mindset of persons who would be availing housing loans. Clustering can be done based on parameters such as interest rates, documentation, processing fee, number of installments etc.

14.3.1 Process

There are two ways in which Cluster Analysis can be carried out:

1. First, objects/respondents are segmented into a pre-decided number of clusters. In this case, a method called non-hierarchical method can be used, which partitions data into the specified number of clusters
2. The second method is called the hierarchical method.

The above two are basic approaches used in cluster analysis. This can be used to segment customer groups for a brand or product category, or to segment retail stores into similar groups based on selected variables.

14.3.2 Interpretation of Results

Ideally, the variables should be measured on an interval or ratio scale. This is because the clustering techniques use the distance measure to find the closest objects to group into a cluster. An example of its use can be clustering of towns similar to each other which will help decide where to locate new retail stores.

If clusters of customers are found based on their attitudes towards new products and interest in different kinds of activities, an estimate of the segment size for each segment of the population can be obtained, by looking at the number of objects in each cluster.

Names can also be given to clusters to describe each one. For example, there can be a cluster called "neo-rich". Segments are prioritised based on their estimated size.

Marketing strategies for each segment are fine-tuned based on the segment characteristics. For instance, a segment of customers, like sports car, get a special promotional offer during specific period.

Example: In cluster analysis, the following five steps to be used:

(1) Selection of the sample to be clustered (buyers, products, employees)

(2) Definition on which the measurement to be made (E.g.: product attributes, buyer characteristics, employees' qualification)

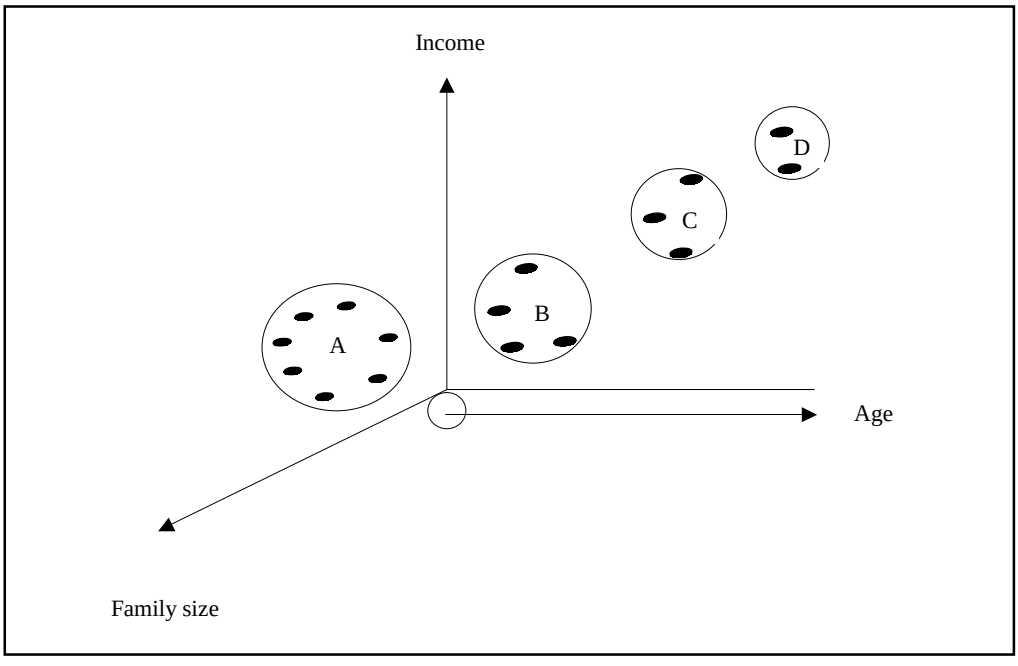
(3) Computing the similarities among the entities.

(4) Arrange the cluster in a hierarchy.

(5) Cluster comparison and validation.

14.3.3 Cluster Analysis on Three Dimensions

The example below shows Cluster Analysis based on three dimensions age, income and family size. Cluster Analysis is used to segment the car-buying population in a Metro. For example "A" might represent potential buyers of low end cars. Example: Maruti 800 (for common man). These are people who are graduating from the two-wheeler market segment. Cluster "B" may represent mid-population segment buying Zen, Santro, Alto etc. Cluster "C" represents car buyers, who belong to upper strata of society. Buyers of Lancer, Honda city etc. Cluster "D" represents the super-rich cluster, i.e. Buyers of Benz, BMW etc.



Matching Measure

Example: Suppose there are five attributes, 1 to 5, on which we are judging two objects A and B. The existence of an attribute may be indicated by 1 and its absence by 0. In this way, two objects are viewed as similar if they share common attributes.

Attribute	1	2	3	4	5	6	7
Brand – A	1	0	0	1	0	0	1
Brand – B	0	0	1	1	1	0	0

One measure of simple matching S is given by:

$$S = \frac{a + d}{a + b + c + d}$$

Where a = No. of attributes possessed by brands A and B

b = No. of attributes possessed by brand A but not by brand B

c = No. of attributes possessed by brand B but not by brand A

d = No. of attributes not possessed by both brands.

Substituting, we get $S = \frac{1+2}{1+2+2+2} = \frac{3}{7} = 0.43$

A and B's association is to be the extent of 43%.

It is now clear that object A possess attributes 1, 4, and 7 while object B possess the attributes 3, 4 and 5. A glance at the above table will indicate that objects A and B are similar in respect of 2 (0 & 0), 6 (0 & 0) and 4 (1 & 1). In respect of other attributes, there is no similarity between A and B. Now we can arrive at a simple matching measure by (a) counting up the total number of matches - either 0, 0 or 1, (b) dividing this number by the total number of attributes.

Symbolically SAB = M / N

SAB = Similarity between A and B

M = Number of attributes held in common (0 or 1)

N = Total number of attributes

SAB = 3 / 7 = 0.43

i.e., A & B are similar to the extent of 43%.

14.4 SPSS AND ITS APPLICATIONS

Stage 1

Enter the input data along with variable and value labels in an spss file

1. Click on STATISTICS at the spss menu bar.
2. Click on CLASSIFY followed by HIERACHICAL CLUSTER.
3. Dialogue box will appear select all the variables which are required to be used in cluster analysis. This can be done by clicking on the right arrow to transfer them from the variable list on the left.
4. Click on METHOD. The dialogue box will open. Choose " Between Groups Linkage" as the CLUSTER METHOD.
5. Click CONTINUE to return to main dialogue box.

6. Click STATISTICS on the main dialogue box. Choose " Agglomeration schedule" so that it will appear in the final output click CONTINUE
7. Choose DENDROGRAM then on the box called ICICLE, Choose " All Clusters" and "Vertical".
8. Click OK on the main dialogue box to get the output of the hierarchical cluster analysis.

Stage 2

This stage is used to know how many clusters are required. This stage is called K-MEANS CLUSTERING.

1. Click CLASSIFY, followed by K- FANS CLUSTER desired
2. Fill in the desired number of clusters that has been identified from stage 1
3. Click OPTIONS on the main dialogue box. Select " Initial Cluster Centers". Then click CONTINUE to return to the main dialogue box.
4. Click OK on the main dialogue box to get the output which has final clusters.

Input data has to be typed in an SPSS file.

1. Click on STATISTICS at the SPSS menu bar
2. Click on CLASSIFY followed by DISCRIMINANT
3. Dialogue box will appear. Select the Grouping Variable. This can be done by clicking on the right arrow to transfer them from the variable list on the left to the grouping variable box on the right
4. Define the range of values by clicking on DEFINE RANGE. Enter Minimum and Maximum value then click CONTINUE.
5. Select all the independent variable for discriminant analysis from the variable list by clicking on the arrow that transfers them to box on the right.
6. Click on STATISTICS on the lower part of main dialogue box. This will open up a smaller dialogue box.
7. Click on CLASSIFY on the lower part of the main dialogue box select SUMMARY TABLE under the heading DISPLAY in a small dialogue box that appears.
8. Click OK to get the discriminant analysis output.

14.5 MDS

14.5.1 Multi Dimension Scaling

This is used to study consumer attitudes, particularly with respect to perceptions and preferences. These techniques help to identify the product attributes, that are important to the customers, and to measure their relative importance. MDS is useful in studying the following:

1. (a) What are the major attributes considered while choosing a product (soft drinks, modes of transportation). (b) Which attributes customers compare to evaluate different brand of the product? Is it price, quality, availability etc.?
2. Which is the ideal combination of attributes according to the customer? (i.e., Which two or more attributes consumer will consider, before deciding to buy).
3. Which advertising messages is compatible with consumer's brand perceptions?

This scaling is used to describe similarity and preference of brands. The respondents are asked to indicate their perception, or the similarity between various objects (products, brands, etc.) and preference among objects. This scaling is also called as perceptual mapping.

There are two ways of collecting input data to plot perceptual mapping

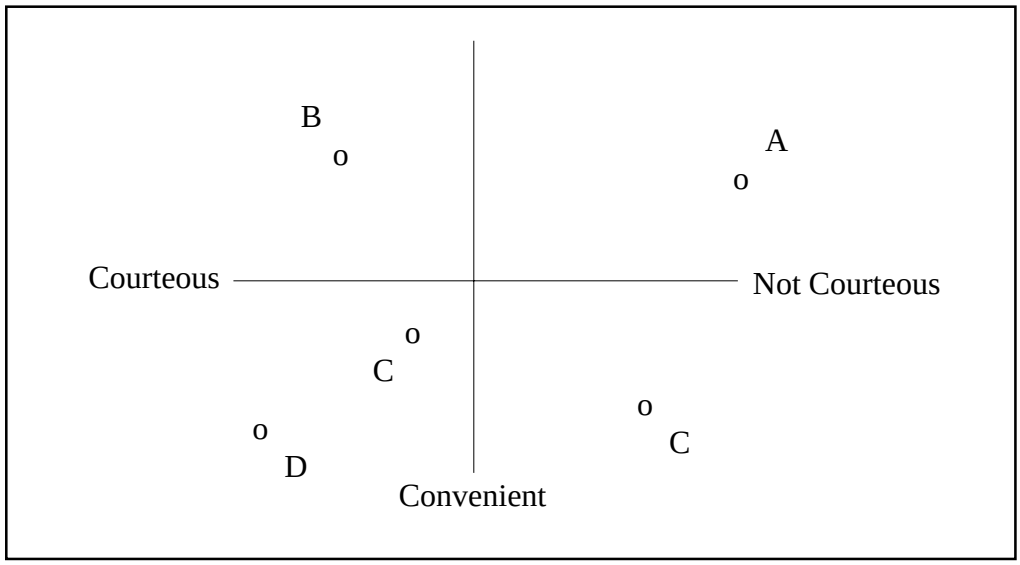
(1) Non-attribute method

(2) Attribute method

1. ***Non-attribute method:*** Here the researcher asks the respondent to make judgment about the objects directly. In this method, the criteria for comparing the objects is decided by the respondent himself.

2. ***Attribute method:*** In this method, instead of respondents selecting the criteria, the respondents are asked to compare the objects based on the criteria specified by the researcher.

E.g.: To find perception of a consumer: Assume there are 5 insurance companies, to be evaluated on 2 attributes namely (1) convenient locality (2) courteous personal. Customers perception regarding the 5 insurance company is as follows:



A, B, C, D, and E are 5 insurance companies.

From the map B & E are dissimilar insurance companies.

C is located very conveniently

A is less convenient in location compared to E

D is less convenient in location than C

E is less convenient location compared to D

14.5.2 Use of Multi Dimensional Scaling

1. To determine salient product attribute perceived by buyer in the market.
2. To know the combination of attributes buyers must prefer
3. To understand the products which are viewed as substitutes and those that are differentiated.

4. For segmenting the market.

14.5.3 What are the tools used in MDS?

Software such as SPSS, SAS and Excel are the packages used in MDS. Brand positioning research is one of SPSS's important features. SAS is business intelligence software. Excel is also used to a certain extent.

14.5.4 Limitations of M D S

1. Conceptual problem: Criteria on which similarities are gauged may vary during an interview with respondents. They vary depending on what respondent thinks. A customer may buy something for him self or he may gift a product to others. In both the cases criteria used for selection are different.
2. Preference: Keeps changing from time to time
3. Complicated computational problem.

Check Your Progress

1. What are the different steps involved in interpretation of results in cluster analysis?
2. What is multi-dimensional scaling?

14.6 DISCRIMINANT ANALYSIS

In this analysis, two or more groups are compared. In the final analysis, we need to find out whether the groups differ one from another.

Example: Where discriminant analysis is used

1. Those who buy our brand and those who buy competitors' brand.
2. Good salesman, poor salesman, medium salesman
3. Those who go to Food World to buy and those who buy in a Kirana shop.
4. Heavy user, medium user and light user of the product.

Suppose there is a comparison between the groups mentioned as above along with demographic and socio-economic factors, then discriminant analysis can be used. One way of doing this is to proceed and calculate the income, age, educational level, so that the profile of each group could be determined. Comparing the two groups based on one variable alone would be informative but it would not indicate the relative importance of each variable in distinguishing the groups. This is because several variables within the group will have some correlation which means that one variable is not independent of the other.

If we are interested in segmenting the market using income and education, we would be interested in the total effect of two variables in combinations, and not their effects separately. Further, we would be interested in determining which of the variables are more important or had a greater impact. To summarize, we can say, that Discriminant Analysis can be used when we want to consider the variables simultaneously to take into account their interrelationship.

Like regression, the value of dependent variable is calculated by using the data of independent variable.

$Z = b_1x_1+b_2x+b_3x_3+.....$

Z= Discriminant score

b_1= Discriminant weight for variable

x = Independent variable

As can be seen in the above, each independent variable is multiplied by its corresponding weightage.

This results in a single composite discriminant score for each individual. By taking the average of discriminant score of the individuals within a certain group, we create a group mean. This is known as centroid. If the analysis involves two groups, there are two centroids. This is very similar to multiple regression, except that different types of variables are involved.

Application: A company manufacturing FMCG products introduces a sales contest among its marketing executives to find out "How many distributors can be roped in to handle the company's product". Assume that this contest runs for three months. Each marketing executive is given target regarding number of new distributors and sales they can generate during the period. This target is fixed and based on the past sales achieved by them about which, the data is available in the company. It is also announced that marketing executives who add 15 or more distributors will be given a Maruti omni-van as prize. Those who generate between 5 and 10 distributors will be given a two-wheeler as the prize. Those who generate less than 5 distributors will get nothing. Now assume that 5 marketing executives won a Maruti van and 4 won a two-wheeler.

The company now wants to find out, "Which activities of the marketing executive made the difference in terms of winning a prize and not winning the prize". One can proceed in a number of ways. The company could compare those who won the Maruti van against the others. Alternatively, the company might compare those who won, one of the two prizes against those who won nothing. It might compare each group against each of the other two.

Discriminant analysis will highlight the difference in activities performed by each group members to get the prize. The activity might include:

1. More number of calls made to the distributors.
2. More personal visits to the distributors with advance appointments.
3. Use of better convincing skills.

Discriminant Analysis

1. What variable discriminates various groups as above; the number of groups could be two or more. Dealing with more than two groups is called Multiple Discriminant Analysis (M.D.A).
2. Can discriminating variables be chosen to forecast the group to which the brand/ person/place belong to?
3. Is it possible to estimate the size of different groups?

14.7 LET US SUM UP

The main purpose of Factor Analysis is to group large set of variable factors into fewer factors. Each factor will account for one or more component. Each factor a combination of many variables. There are two most commonly employed factor analysis procedures. They are:

(1) Principle component analysis

(2) Common factor analysis

Cluster Analysis is a technique used for classifying objects into groups. This can be used to sort data (a number of people, companies, cities, brands or any other objects) into homogeneous groups based on their characteristics.

Multi Dimension Scaling is used to study consumer attitudes, particularly with respect to perceptions and preferences. These techniques help to identify the product attributes, that are important to the customers, and to measure their relative importance.

This scaling is used to describe similarity and preference of brands. The respondents are asked to indicate their perception, or the similarity between various objects (products, brands, etc.) and preference among objects. This scaling is also called as perceptual mapping.

In Discriminant Analysis, two or more groups are compared. In the final analysis, we need to find out whether the groups differ one from another.

14.8 LESSON END ACTIVITY

A marketing research company collected the data and tabulated the frequency count between age and watching movies.

Visited movies	Under 40	More than 40	Total
Yes	42	71	113
No	51	65	116
Total	93	136	229

What conclusion can be drawn from the above observation?

14.9 KEYWORDS

Factor Analysis

Cluster Analysis

SPSS

MDS

14.10 QUESTIONS FOR DISCUSSION

1. Write short note on:
   (a) Factor Analysis
   (b) Cluster Analysis
2. Expand the term: SPSS, MDS
3. Discuss Applications of SPSS.

14.11 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases",* All India Traveller Bookseller, New Delhi.

Brown, F.E. *"Marketing Research, a structure for decision making",* Addison- Wesley Publishing Company.

Kothari, C.R. *"Research Methodology- Methods and Techniques",* Wiley Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics",* D.B. Taraporevala Sons and Co. Private Limited, Bombay.

UNIT-V

LESSON

15

INTERPRETATION

CONTENTS

After studying this chapter, you should be able to understand:

15.0 AIMS AND OBJECTIVES

This lesson is intended to focus on the interpretation of collected data. After studying this lesson you will be able to:

(i) define interpretation.

(ii) describe induction and deduction methods of data interpretation.

(iii) interpret regression equation.

15.1 INTRODUCTION

So far we have discussed theoretical aspects of research in previous lessons. But it is very important to draw inferences from the data collected by the researcher. Interpretation refers to the task of drawing inferences from the collected data. Interpretation is the tool by which further research can be undertaken.

15.2 MEANING

Interpretation is not just the repetition of the data is the table, it should be the inferences, insights, relationships and correlation between the variables.

Interpretation means bringing out the meaning of data. We can also say that interpretation is to convert data into information. The essence of any research is to do interpretation about the study. This requires a high degree of skill.

15.3 TECHNIQUES OF INTERPRETATION

There are two methods of drawing conclusions (1) induction (2) deduction.

In the induction method, one starts from observed data and then generalisation is done which explains the relationship between objects observed.

On the other hand, deductive reasoning starts from some general law and is then applied to a particular instance i.e., deduction comes from the general to a particular situation.

Example of Induction: All products manufactured by Sony are excellent. DVD player model 2602 MX is made by Sony. Therefore, it must be excellent.

Example of Deduction: All products have to reach decline stage one day and become obsolete. This radio is in decline mode. Therefore, it will become obsolete.

During the inductive phase, we reason from observation. During the deductive phase, we reason towards the observation. Both logic and observation are essential for interpretation.

Successful interpretation depends on how well the data is analysed. If data is not properly analysed, the interpretation may go wrong. If analysis has to be corrected, then data collection must be proper. Similarly, if the data collected is proper but analysed wrongly, then too the interpretation or conclusion will be wrong. Sometimes, even with the proper data and proper analysis, the data can still lead to wrong interpretation. Interpretation depends upon the experience of the researcher and methods used by him for interpretation.

Example: A detergent manufacturer is trying to decide which of the three sales promotion methods (discount, contest, buy one get one free) would be most effective in increasing the sales. Each sales promotion method is run at different times in different cities. The sales obtained by the different sale promotion methods is as follows:

Sales Impact of Different Sale Promotion Methods

Sales Promotion Method	Sales Associated with Sales Promotion
1	2,000
2	3,500
3	2,510

The results may lead us to the conclusion that the second sales promotion method was the most effective in developing sales. This may be adopted nationally to promote the product. But one cannot say that the same method of sales promotion will be effective in each and every city under study.

Precautions:

(1) Keep the main objective of research in mind.

(2) Analysis of data should start from simpler and more fundamental aspects.

(3) It should not be confusing.

(4) The sample size should be adequate.

(5) Take care before generalising of the sample studied.

(6) Give due attention to significant questions.

(7) Do not miss the significance of some answers, because they are found from very few respondents, such as “don’t know” or “can’t say”.

Check Your Progress

XYZ company is into pharmaceuticals to produce a medicine 'A', which is a pain reliever. A survey was conducted with doctors as sample and the following questions were asked:

"Would you recommend product 'A' to your patients when they suffer from pain"?

Yes _____ No _____

An analysis of the above showed that 75% of doctors surveyed said 'Yes', the rest said 'No'. From this survey, XYZ company made the following inference. "Three out of four doctors have recommended product 'A' for their patients, who suffer from pain".

1. Is the inference valid?
2. If not, how else will you confirm that three out of four doctors have recommended this?

15.4 INTERPRETATION OF REGRESSION EQUATION

The multiple linear regression equation is given by

$$y = a + b_1x_1 + b_2x_2$$

The 'b's are called partial regression coefficient and indicate the average change in y for a unit change in x_1 holding the other x's constant.

If b_1 is 1.25, then it shows that y increases by 1.25 for every unit increase in x_1.

15.5 LET US SUM UP

In this lesson we have studied the meaning and techniques of interpretation of collected data. Interpretation refers to the task of drawing inferences from the collected data. There are two techniques of interpretation– inductive and deductive. We have also studied the interpretation of regression equation.

15.6 LESSON-END ACTIVITY

You have collected data on employees of a large organisation in a metro. You analyse the data by the type of work, education level, whether the employee belongs to an urban or rural area. The results are as below. How would you interpret them?

Annual Employee Turnover

	Higher Education		Lower Education	
	Salaried monthly	Daily wage	Salaried monthly	Daily wage
Rural	6	14	18	18
Urban	10	12	19	20

*Turnover per 1,000 employees

15.7 KEYWORDS

Data interpretation
Induction
Deduction
Regression equation
Inferences

15.8 QUESTIONS FOR DISCUSSION

1. What do you understand by the term ‘interpretation?’
2. Discuss the techniques of interpretation.
3. Write a note on interpretation of regression equation.

15.9 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods*, Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases"*, All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision-making"*, Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology- Methods and Techniques"*, *Wiley* Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics"*, D.B. Taraporevala Sons and Co. Private Limited, Bombay.

LESSON

16

REPORT WRITING

CONTENTS

16.0 AIMS AND OBJECTIVES

The purpose of this lesson is to give guidance in writing a research report which is simply the presentation of research findings to specific audience. After studying this lesson you will be able to:

(i) know the requirement of report writing.

(ii) understand the format of written report.

(iii) describe various types of report writing.

(iv) use tables, charts and diagrams in report writing.

16.1 INTRODUCTION

The last step in the research process in the preparation and presentation of the research report. The best of research efforts will be of little value unless the result can be summarised and communicated to the management in a form that is both understandable and useful. Preparation and presentation of the research report is the most important part of the research process. If the report is confusing or poorly written, time and money spent on collecting and analysing data will be wasted.

16.2 SIGNIFICANCE OF REPORT WRITING

1. If research results are unknown objective of research is not achieved, so reporting is must.
2. Orally it is not possible to explain in detail, so reporting is helpful.
3. As a matter of evidence to the research report is necessary.

16.3 STEPS IN REPORT WRITING

Having decided on the type of report, the next step is report preparation. The following is the format of a research report:

1. Title Page
2. Page Contents
3. Executive Summary
   - ❖ Objectives
   - ❖ Results
   - ❖ Conclusions
   - ❖ Recommendations
4. Body
   - ❖ Introduction
   - ❖ Methodology
   - ❖ Results
   - ❖ Limitations
5. Conclusions and Recommendations
6. Appendix
   - ❖ Sampling plan
   - ❖ Data collection forms
   - ❖ Bibliography

(1) ***Title Page:*** Title Page should indicate the topic on which the report is prepared. It should include the name of the person or agency who has prepared the report. The date of the submission of the report is to be included in the report.

(2) ***Table of Contents:*** The table of contents will help the reader to know "what the report contains". The table of contents should indicate the various parts or sections of the report. It should also indicate the chapter headings along with the page number.

Table of Contents

Section	Description	Page No.
I	Background, Purpose of study	1-3
II	Methodology	4-8
III	Analysis and interpretations	9-10
IV	Findings	11-12
V	Recommendations	13
VI	Conclusion	14
VII	Appendix a) Questionnaire b) Exhibits c) Bibliography	 16-25 26-40 41

(3) ***Executive Summary:*** If your report is long and drawn out, the person to whom you have prepared the report may not have the time to read it in detail. Apart from this, an executive summary will help in highlighting major points. It is a condensed version of the whole report. It should be written in one or two pages. Since top executives read only the executive summary, it should be accurate and well-written. An executive summary should help in decision-making.

An executive summary should have,

- ❖ Objectives of the research report
- ❖ Scope of the study
- ❖ Limitations
- ❖ Key results
- ❖ Conclusions
- ❖ Recommendations

(4) ***The Body:*** This section includes:

- ❖ Introduction
- ❖ Methodology
- ❖ Results
- ❖ Limitations

Introduction: The introduction must explain clearly the decision problem and research objective. The background information should be provided on the product and services provided by the organisation which is under study.

Methodology: How you have collected the data is the key in this section. For example, Was primary data collected or secondary data used? Was a questionnaire used? What was the sample size and sampling plan and method of analysis? Was the design exploratory or conclusive?

Results: What was the final result of the study?

Limitations: Every report will have some shortcoming. The limitations may be of time, geographical area, the methodology adopted, correctness of the responses, etc.

(5) ***Conclusion and Recommendation:***

- ❖ What was the conclusion drawn from the study?
- ❖ Based on the study, what recommendation do you make?

(6) ***Appendix:*** The purpose of an appendix is to provide a place for material which is not absolutely essential to the body of the report. The appendix will contain copies of data collection forms called questionnaires, details of the annual report of the company, details of graphs/charts, photographs, CDs, interviewers instructions.

- ***Bibliography:*** If portions of your report are based on secondary data, use a bibliography section to list the publications or sources that you have consulted. The bibliography should include, title of the book, name of the journal in case of article, volume number, page number, edition etc.

16.4 LAYOUT OF REPORT

Chapter no.	Title of the chapter	Page no.
	Declaration	
	Certificates	
	Acknowledgement	
	Executive summary	
1	Introduction to the project	
2	Research design and methodology Theoretical perspective of the study	
3	Company and industry profile	
4	Data analysis and interpretation Summary of findings and suggestions	
5	Bibliography	
6	Appendix	

16.5 TYPES OF REPORTS

(A) Reports can be classified based on the time-interval such as:

(1) Daily
(2) Weekly
(3) Monthly
(4) Quarterly
(5) Yearly

(B) Type of reports:

(1) Short report
(2) Long report
(3) Technical report
(4) Non-technical report
(5) Final report
(6) Informal report
(7) Government report

16.5.1 Short report

Short reports are produced when the problem is very well defined and if the scope is limited. E.g. Monthly sales report. It will run into about five pages. It consists of report about the progress made with respect to a particular product in a clearly specified geographical locations.

16.5.2 Long report

This could be both a technical report as well as non-technical report. This will present the outcome of the research in detail.

16.5.3 Technical report

This will include the sources of data, research procedure, sample design, tools used for gathering data, data analysis methods used, appendix, conclusion and detailed recommendations with respect to specific findings. If any journal, paper or periodical is referred, such references must be given for the benefit of reader.

16.5.4 Non-technical report

This report is meant for those who are not technically qualified. E.g. Chief of the finance department. He may be interested in financial implications only, such as margins, volumes etc. He may not be interested in the methodology.

16.5.5 Final report

Example: The report prepared by the marketing manager to be submitted to the Vice-President (marketing) on quarterly performance, reports on test marketing.

16.5.6 Informal report

The report prepared by the supervisor by way of filling the shift log book, to be used by his colleagues.

16.5.7 Government report

These may be prepared by state governments or the central government on a given issue.

Example: Programme announced for rural employment strategy as a part of five-year plan or report on children's education etc.

Check Your Progress

1. What are the different steps in report writing?
2. Draft a layout of any technical report

16.6 EXECUTIVE SUMMARY

Following are covered in executive summary:

1. Statement of the problem
2. Important objectives
3. Brief methodology
4. Major findings
5. Important recommendations

16.7 MECHANICS OF WRITING REPORTS

1. size and physical design
2. procedure

3. layout
4. treatment of quotations
5. the foot notes
6. documentation style
7. punctuation and abbreviations in foot notes

16.8 PRECAUTIONS FOR WRITING REPORT

1. A4 bond paper to be used for better quality.
2. dull printing should be avoided.
3. technical jargons should be avoided.
4. tables, graphs to be used in order to quick understanding by the readers.
5. reports should be free from grammatical mistakes.
6. bibliography and index should be written systematically.
7. report must be attractive in appearance.
8. findings of the report should attempt to solve the problem.

16.9 NORMS FOR USING TABLES, CHARTS AND DIAGRAMS

Tables

General Rules

(i) The table should be simple and compact which is not overloaded with details.

(ii) Tabulation should be in accordance with the objective of investigation.

(iii) The unit of measurements must always be indicated in the table.

(iv) The captions and stubs must be arranged in a systematic manner so that it is easy to grasp the table.

(v) A table should be complete and self explanatory.

(vi) As far as possible the interpretative figures like totals, ratios and percentages must also be provided in a table.

(vii) The entries in a table should be accurate.

(viii) Table should be attractive to draw the attention of readers.

16.10 GRAPHS

i. Every graph must have a suitable title written at its top. This title should indicate the facts presented by the graph in comprehensive and unambiguous manner.

ii. By convention, the independent variable is normally measured along X-axis and the dependent variable on Y-axis. The sale on Y-axis must always start from zero. If the fluctuations are small as compared to the size of the variable, there is no need to show the entire vertical axis from origin. This can be done by showing a gap in the vertical axis and drawing a horizontal line from it. This line is often termed as a false base line.

iii. The choice of a scale of measurement should be such that the whole data can be accommodated in the available space and all of its important fluctuations are clearly depicted.

iv. Proportional changes in the values of the variables can be shown by drawing a ratio or logarithmic scale.

v. A graph must not be overcrowded with curves.

vi. An index should always be given to show the scales and the interpretation of different curves.

vii. The source of data should be mentioned as a footnote.

16.11 NORMS FOR USING INDEX AND BIBLIOGRAPHY

Bibliography, the last section of the report comes after appendices. Appendices contains questionnaires and other relevant material of the study. The bibliography contains the source of every reference used and any other relevant work that has been consulted. It imparts an authenticity regarding the source of data to the reader.

Bibliography are of different types viz., bibliography of works cited; this contains only the items referred in the text. A selected bibliography lists the items which the author thinks are of primary interest to the reader. An annotated bibliography gives brief description of each item. The method of representing bibliography is explained below.

Books

Name of the author, title of the book (underlined), publisher's detail, year of publishing, page number.

- Single Volume Works. Dube, S. C. *"India's Changing Villages"*, Routledge and Kegan Paul Ltd., 1958, p. 76.

Chapter in an edited book

- Warwick, Donald P., *"Comparative Research Methods"* in Balmer, Martin and Donald Warwick (eds) 1983, pp. 315-30.

Periodicals Journal

- Dawan Radile (2005), *"They Survived Business World"* (India), May 98, pp. 29-36.

Newspaper, Articles

- Kumar Naresh, *"Exploring Divestment"* The Economic Times (Bangalore), August 7, 1999, p. 14.

Website

- www.infocom.in.com

For citing Seminar paper

- Krishna Murthy, P., *"Towards Excellence in Management"* (Paper presented at a Seminar in XYZ College Bangalore, July 2000).

16.12 LET US SUM UP

The most important aspect to be kept in mind while developing research report, is the communication with the audience. Report should be able to draw the interest of the readers. Therefore, report should be reader centric. Other aspect to be considered while writing report are accuracy and clarity.

Written report may be classified based on whether the report is a short report or a long report. It can also be classified based on technical report or non technical report. Written report should contain title page, contents, executive summary. Body conclusions and appendix. The last part is bibliography.

16.13 LESSON-END ACTIVITY

In a company named XYZ, there have been increasing number of strikes. You have to found various reasons of strikes. Answer the following questions:

(i) what information need to be collected

(ii) Write a few lines–starting and ending–of your report

16.14 KEYWORDS

Written report

Informal report

Technical report

Appendix

Bibliography

Body page content

Executive summary

16.15 QUESTIONS FOR DISCUSSION

1. What is meant by "consider the audience" when writing a research report?
2. What are the various criteria used for classification of written report?
3. What are the essential contents of the following parts of research report?
   a. Table of contents
   b. Title page
   c. Executive summary
   d. Introduction
   e. Conclusion
   f. Appendix

16.16 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods,* Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases",* All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision making",* Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology - Methods and Techniques",* Wiley Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics",* D.B. Taraporevala Sons and Co. Private Limited, Bombay.

LESSON 17

ORAL PRESENTATION

CONTENTS

17.0 AIMS AND OBJECTIVES

This lesson is intended to give guidance for oral presentation of a research report. After studying this lesson you will be able to:

(i) know the broad classification of an oral presentation.

(ii) know the guidelines for preparing oral report.

(iii) understand the requirement of oral presentation of research report.

17.1 INTRODUCTION

The oral report is required when the researchers are asked to make an oral presentation. Making an oral presentation is somewhat difficult compared to the written report. In an oral presentation, communication plays a big role. A lot of preparation is required for oral presentation. The broad classification of an oral present has been discussed below.

17.2 NATURE OF AN ORAL PRESENATION

17.2.1 Opening

A brief statement can be made on the nature of discussion that will follow. The opening statement should explain the nature of the project, how it came about and what was attempted.

17.2.2 Finding/Conclusion

Each conclusion may be stated backed up by findings.

17.2.3 Recommendation

Each recommendation must have the support of conclusion. At the end of the presentation, question-answer session should follow from the audience.

17.2.4 Method of Presentation

Visuals, if need to be exhibited, can be made use of. The use of tabular form for statistical information would help the audience.

(a) What type of presentation is a root question? Is it read from a manuscript or memorised or delivered ex-tempo. Memorisation is not recommended, since there could be a slip during presentation. Secondly, it produces speaker-centric approach. Even reading from the manuscript is not recommended, because it becomes monotonous, dull and lifeless. The best way to deliver in ex-tempo, is to make main points notes, so that the same can be expanded. Logical sequences should be followed.

Points to remember in oral presentation:

(1) Language used must be simple and understandable.

(2) Time Management should be adhered.

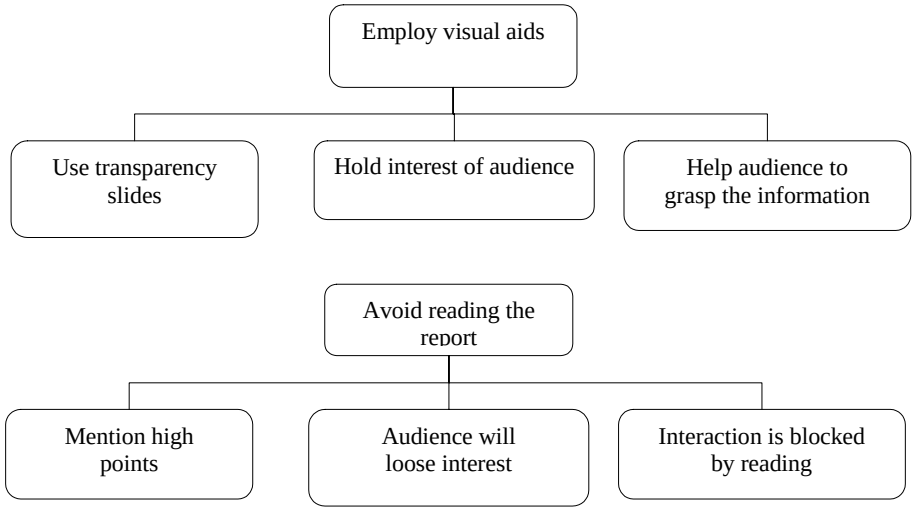
(3) Use of charts, graph etc. will enhance understanding by the audience.

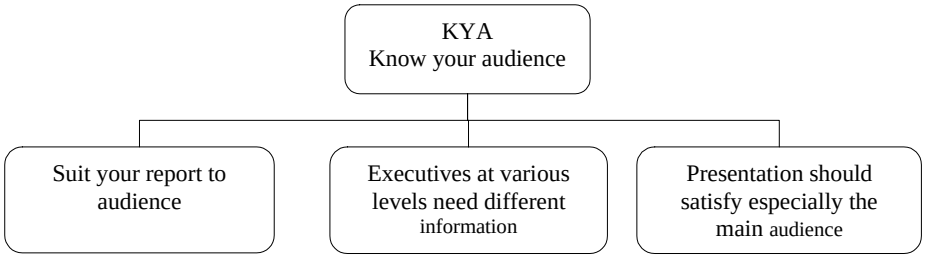
(4) Vital data such as figures may be printed and circulated to the audience so that their ability to comprehend increases, since they can refer to it when the presentation is going on.

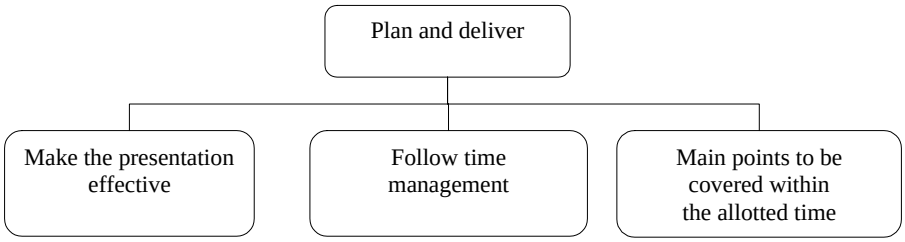
(5) The presenter should know his target audience well in advance to prepare tailor- made presentation.

(6) The presenter should know the purpose of report such as "Is it for making a decision", "Is it for the sake of information" etc.

17.3 GUIDELINES







17.4 CHECKLIST FOR ORAL PRESENTATION

Many companies require oral presentation of research reports. Prior to the presentation follow this checklist:

1. Check all equipment (e.g., light, microphones, projectors etc.) thoroughly before the presentation.
2. Have a contingency plan for equipment failure.
3. Analyze your audience. How will they react to the research findings?
4. Practice the presentation several times. If possible, have someone comment on how to improve its effectiveness.
5. Start the presentation with an overview - tell the audience what you are going to tell them.
6. Face the audience directly at all times.
7. Talk to the audience or decision makers, rather than read from a script or a projection screen.
8. Use visual aids effectively - charts and tables should be simple and easy to read.
9. Avoid distracting mannerisms while speaking.
10. Remember to ask the audience if they have any questions after your report is concluded.

17.5 LET US SUM UP

Making an oral presentation is somewhat difficult compared to the written report because the reporter has to interact directly with the audience. We have discussed in this lesson the various facets of oral presentation, classification and guidelines for preparing oral presentation. In the end we have provided checklist to be followed before presentation.

17.6 LESSON-END ACTIVITY

Do you agree that making an oral presentation is somewhat difficult compared to the written report? Give reasons.

17.7 KEYWORDS

Opening Statement

Concluding Statement

Oral report

Presentation

17.8 QUESTIONS FOR DISCUSSION

1. What are the criterion for an oral report? Explain.
2. On what criteria, oral report is evaluated? Suggest a suitable format.
3. Why are visual aids used in oral presentation?
4. Oral presentation requires the researcher to be good public speaker. Explain.

17.9 SUGGESTED READINGS

S. N. Murthy and U. Bhojanna, *Business Research Methods*, Excel Books, 2007.

Boyd, Westfall, and Stasch, *"Marketing Research Text and Cases"*, All India Traveller Bookseller, New Delhi.

Brown, F.E., *"Marketing Research, a structure for decision-making"*, Addison-Wesley Publishing Company.

Kothari, C.R., *"Research Methodology- Methods and Techniques"*, Wiley Eastern Ltd.

Stockton and Clark, *"Introduction to Business and Economic Statistics"*, D.B. Taraporevala Sons and Co. Private Limited, Bombay.

GLOSSARY

A

Attribute method: It is a method in which attributes are selected and given to respondent based on which, he is asked to indicate similarities between objects.

Accuracy: Criterion used to evaluate a research report.

Area Sampling: It is a type of cluster sampling. Clusters are formed based on Geographical locations.

ANOVA: It is a statistical technique employed to determine, if samples came from the population with equal means.

Applied Research: Research undertaken to solve specific real life problems.

B

Bivariate Analysis: It is a Multi variate analysis using two variables.

Bidder: One who bids (say a contract or tender).

Bipolar adjectives: It is a scale that has adjective at each end, that is antonym.

Balanced scale: A scale with same number of favourable and unfavourable responses.

Bivariate statistics: Statistics used when a researcher investigates 2 variables at a time.

C

Coding: Technical procedure by which data is categorised. It specifies the categories into which responses are to be placed.

Cluster Sampling: Cluster selected and all the items in the cluster are studied.

Census: Involves all units of the population.

Chi square Test: A non parametric test. This test will tell whether there is any significant relationship between two variables.

Cartoon test: It is a projective technique. In this method cartoon characters are the 3rd party.

C.R.M: Customer relations management .

Client: A prospective customer.

Causal research: It is a research in which cause and effect relationship is determined.

Consumer purchase data: A type of syndicated data.

Cluster Analysis: A technique for segmenting E.g. - Customers, products etc.

Causal research: A research designed to determine cause and effect relationship.

Construct validity: Trait, the instrument is in fact measuring. It is the construct, measured by the scale.

Cox and Stuart test: A test used to find out presence of trends.

Content validity: Represents how appropriate is a measuring instrument for getting the desired information.

Concomitant variation: It is the extent to which cause and effect vary together.

C.M.P: Consumer Mail Panel.

Convenience sample: Sample selected by researcher based on his convenience.

Cross sectional study: Investigation involving a sample of element selected from the population of interest at a single point of time.

Con Joint Analysis: It is concerned with the measurement of the Joint effect of 2 or more attribute that is important from the customer's view point.

Cross tabulation: It is method of counting the number of cases which fall into each of the categories when the categories are based on 2 or more variables considered simultaneously.

Correlation: A statistical technique which explains the extent to which the 2 variables are related.

Close ended question : A type of question for which limited options are indicated.

Conclusive research : A kind of research where specific action is taken to solve the problem.

D

Depth interview: It is an unstructured personal interview.

Descriptive research: This is a research design method. Emphasis is on determining the frequency with which, something occurs.

Dichotomous question: Question with just fixed alternatives.

Deliberate sampling : It is a non probability sampling. Also known as purposive sampling.

Dependent variable : This is a variable which is under study.

Delphi technique: It is a group judgement. Each member make an individual judgement and then each member is given opportunity to revise his or her judgement after seeing others.

Disguised: A form in which the sample are not aware that they are under study.

Degree of freedom: Number of observations that can vary freely under certain conditions.

(Double barrled Question): Two questions are clubbed into one.

Dispersion: It is the spread of the data in a distribution.

E

Ethics: Moral standards or code of conduct.

Editing: Inspection and correction of questionnaire.

Experiment: Scientific investigation in which the researcher studies dependent variable by altering independent variable.

Exploratory research: This research is used to generate ideas when the hypothesis is vague.

Extraneous variable: These variables affect the response of test units. Also called as confounding variable.

External validity: The degree to which the results of an experiment can be generalised beyond the experimental situation to other population.

External data: Data that originate outside the organisation for which research is being done.

Experimental Mortality: An extraneous factor affecting experiment.

Ex post facto research: Study of current state and factors causing it.

F

Factor Analysis: It is a technique used to study interrelationship among many variables.

Factorial design: This is an experimental design when the effect of 2 or more variables are being studied simultaneously.

Field edit: Preliminary edit conducted by field supervisor. This is done to correct glaring omissions.

F-Statistics: Measure of the variance between groups divided by the variance within group.

Focus group: Group discussion focused on a series of topics. The group is headed by a moderator.

Field study: Involves in-depth study of the problem.

Frequency: Number of times target audience is exposed to media vehicle during a specific period.

Field survey: Survey conducted in the market place such as shopping mall,

H

History: Specific events external to an experiment but occurring at the same time that may affect the results.

Hypothesis: A presumption which a researcher wants to verify.

Horse racing alternative: It refers to a product testing method, where several products of the same company are put to test against one another.

Horizontal Marketing: Two entities with distinctive strength coming together to achieve a common goal.

I

Instrumentation effect: Effect of, change in the measuring instrument, on the experimental results.

Internal validity: Ability of an experiment to show relationship unambiguously.

Interval scale: Scale, where the units have the same width throughout the scale.

Interval estimate: It is a range within which a parameter is expected to lie.

Internal data: Data which originates within the organisation.

Inquiry test: A test designed to measure effectiveness of an advertisement.

Independent variable: These are variables whose effects researcher wishes to examine.

J

Judgement sampling: This is a non probability sampling.

K

Kolmogorov-smirnov test: This is a test to find whether 2 independent samples are drawn from the same population or not.

Kruskal-Wallis test: Rank sum test that analyses whether 2 or more independent samples are drawn from identical population or from 2 or more population with the same median. This is also called as H test.

L

Latin square design: It is an experimental design.

Likert scale: Scale in which respondent indicates agreement or disagreement.

Leading / Loading Question: A question which gives clue to the respondent.

Longitudinal study: This involves fixed samples of elements that is measured repeatedly over a period of time.

Least square method: A technique used to find a regression line.

M

Mail Questionnaire: Questionnaire administered by mail.

Median / Mean: A measure of central tendency.

Maturation: This occurs during research study, changes that takes information sought by the researcher and the information generated.

Multi dimension sealing : Data plotted in a multi dimensional space.

Mortalities: Refers to, respondents dropping out of experiment.

Multivariate Analysis: Studying 2 or more variables.

Mode: Central value of the item or most frequently occurring item.

Mall intercept: This is a method of data collection in which the shoppers are the sampling elements.

Management problem: It is a problem which asks the question "what needs to be done"?.

Moderator: One who facilitates conducting of focus group discussion.

Mann whitney "U" test: Non parametric test.

Multistage sampling: This is a method in which sampling is done in several stages.

N

Nominal scale: It is a scale, where numbers are assigned to objects solely for identification purposes.

Nonparametric test: Statistical tests applicable when the data follows nominal, ordinal measurement. These are distribution free tests.

Non probability sample: Where every element in the universe does not have equal chance of getting included.

Non attribute method: A method in which respondents choose the criteria to compare the objects instead of researcher specifying it.

Non response error: This is a non sampling error, in which respondent does not answer.

O

Omni Bus panel: Panel in which the information collected from participated panel members varies from study to study.

Ordinal scale: A measurement that assigns only order, used for ranking.

Observation error: It is a non sampling error.

Open ended question: A question to which there are no fixed answers. Respondent can answer in his own words.

Oral report: A report prepared for oral presentation.

P

Paired comparison: This is a test conducted to find preferences. The respondent is required to take 2 objects at a time.

Parametric test: These tests are used when variables are measured on interval scale.

Perceptual Map: A spatial representation of the perceived relationship among objects. These objects could be products or brands.

Panel sampling: Fixed sample of respondents, who are used to collect data.

Probability sampling: A sampling method where there is equal chance for every element getting included.

Projective technique: Indirect method of questioning. A technique of qualitative research.

Pretesting: A practice of administering a questionnaire to a small group of respondents.

Predictive validity: This is established by correlating the measurement score with the future criterion.

Precise: Being accurate.

Q

Qualitative research: Research designed mainly for exploratory purposes.

Quota sampling: It is a sampling method, where each sub group is represented.

R

Ratio scale: This scale has an absolute zero and hence it allows comparison of absolute magnitudes.

Rank sum test: This is a test to find out whether independent samples are drawn from the same population.

Random sampling: A sampling method where every element has equal probability of getting selected.

Regression analysis: Statistical technique used to derive an equation.

Recording Error: Error that occurs due to improper recording.

Reliability: An error component of measurement instrument.

Retail Store Audit: It is data collected by research firms whose employees visit sample of stores at fixed interval for checking the stock.

Research design: A plan which indicate the methods and procedures to be used for collecting the data and data Analysis.

Recession: A period when demand for goods slows down.

Research Methodology: It is a method to solve research problem systematically.

S

Sample: Selecting a subset.

Sampling Frame: It is the list of population, from where sample is selected.

Selection Bias: This occurs when there is no way to certify.

Secondary data: Data already collected and published.

Semantic differential: A scale to make attitude measurement. Bipolar adjectives are used at the 2 extreme ends of the scale.

Sentence completion test: It is a projective technique where in the respondents are required to complete a sentence.

Sampling error: Difference between true mean value of the population and the observed mean value.

Snow ball sampling: It is a type of non probability sampling, based on referrals.

Stratified Random Sampling: It is a probability sampling procedure. Population is divided into strata and sample is selected at random from each strata.

Split ballot techniques: This is a method of questioning the respondent in which question split into two halves.

Sentence completion test: It is a non structured, disguised form of questioning.

Syndicated data: Secondary data gathered by agencies sold to clients.

Shopping Mall intercept sampling: This is a non probability sampling.

Systematic sampling: It is a probability sampling where sampling interval remains constant.

T

TAT (Thematic apperception test): It is a non structured disguised form of questioning. Respondents may be shown a picture and asked questions about it.

Thurstone scale: It is an attitude measurement scale with 11 statements, respondents are asked to respond to these statements.

True panel: It is a panel which participates in longitudinal study.

Type-I Error: This error occurs when a true null hypothesis is rejected.

Type-II Error: This error occurs when a false null hypothesis is accepted.

T - Test: It is a parametric test used when the sample size is less than 30.

U

Univariate: Problem of analyzing a single variable.

Unbalanced scale: Scale with uneven number of favorable and unfavorable choices. Therefore, this type pf scale will be skewed in one direction.

Unique selling proposition (USP): It refers to a product or a service attribute that is distinctive to a particular brand.

Unstructured observation: In this method, the observer judges, whether it is worthwhile recording an observation or not.

Undisguised observation: In this case, the purpose for which observation is made known to respondent.

V

Validity: This indicates how much of the scores measured reflects the actual.

Variable: Any thing that may assume different numerical value.

W

Word association test: This is a test in qualitative research.

Z

Z-test: A univariate hypothesis test using the standardized normal distribution.