Institute of **Open** and **Distance Education**

Research Methodology

Research Methodology

2MBA7

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2MBA7

Research Methodology

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LESSON

1

FUNDAMENTALS OF RESEARCH

CONTENTS

1.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Describe meaning and objectives of research
- Differentiate between different types of research
- 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

1. *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.

2. *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?

3. *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:

    (a) Consumption pattern

    (b) Brand loyalty

    (c) Consumer behaviour

    (d) Market trends, etc.

4. *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.

5. *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.

6. *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.

7. *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 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. For 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. For 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. For 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. For 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. For 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. For 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.

Fill in the blanks:

1. Research is an art of ....

2. .... deals with demographic characteristics of the consumer.

3. Applied research deals with .... situations.

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

5. The .... has to depend on the conclusions or inferences drawn in the past.

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 sub-divided, 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 KEYWORDS

Applied Research: Applied research aims at finding a solution for an immediate problem faced by any business organization.

Action Research: Action research is conducted to solve a problem. For example, test marketing a product is an example of action research.

Descriptive Research: This type of research tries to describe the characteristics of the respondent in relation to a particular product.

Library Research: This is done to gather secondary data.

1.6 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?

Check Your Progress: Model Answer

1. scientific investigation

2. Descriptive research

3. real life

4. two variables

5. historical research

1.7 SUGGESTED READINGS

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LESSON

2

RESEARCH PROCESS

CONTENTS

2.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Understand steps involved in research process

- Describe research methodology

- Define problem formulation
- 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 he 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 he 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:

1. Problem formulation

2. Evaluate the cost of research

3. Preparing a list of needed information

4. Research design decision and data collection

5. Select the sample types

6. Determine the sample size

7. Organize the fieldwork

8. Analyze the data and report preparation

9. Data Tabulation

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. For 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.

Illustration 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?"

Solution:

Loss without research $= 3,00,000 \times 0.35$

$= $ Rs. 1,05,000

Loss with research $= 3,00,000 \times 0.30$

$= $ 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.

Illustration 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?

Solution:

$0.4 \times 10 + 0.3 \times 5 - 0.3 \times 7 = 4 + 1.5 - 2.1 = 3.4$ 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:* For 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:*

    (i) Availability of products at different outlets.

    (ii) Effect of shelf display on sales.

(c) *Market awareness, attitude and usage:* For 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:* For example, "What has been the marketing expenditure?" "How much was spent on promotion?"

(e) *Competitors marketing expenditure:* For 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: For 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. For 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? For 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". For 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. For 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.

2.4.9 Data Tabulation

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.

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.

Fill in the blanks:

1. .... is one of the important steps in marketing research.

2. For a researcher, problem formulation means converting the management problem to a ....

3. Every problem is related to either one or more ....

4. A non-probability sampling can be convenience or ....

5. .... is a process of reasoning some premise and then reaching the conclusion which follows from that premise.

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 KEYWORDS

Research Methodology: Research methodology is a method to solve the research problem systematically.

Empirical: Empirical means the factual investigation is possible.

Replicable: It means the research conducted can be repeated by any number of times.

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

2.8 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?

6. What are the components of research? Explain.

7. What is the difference between manager and researcher?

Check Your Progress: Model Answer
1. Research design
2. research problem
3. variable
4. judgment sampling
5. Deduction

2.9 SUGGESTED READINGS

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

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LESSON

3

SCIENTIFIC METHOD IN RESEARCH

CONTENTS

3.0 Aims and Objectives

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3.2 Process and Logic in Scientific Research

3.3 Characteristics of Scientific Method

3.4 Why MR cannot be considered Scientific?

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3.6 Let us Sum up

3.7 Keywords

3.8 Questions for Discussion

3.9 Suggested Readings

3.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

● Define scientific research

● Differentiate between scientific and non-scientific methods of research

● 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 MR 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. For example, 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 MR, 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 e.g., 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

Fill in the blanks:

1. Scientific research is one which yields the .... when it is repeated by different individuals.

2. Accuracy using .... can be ensured.

3. In science, there is ....

4. A questionnaire is administered to find the .... of the respondent towards an objective.

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 KEYWORDS

Validity: Validity is the ability of a measuring instrument to measure what it is supposed to measure.

Hypothesis: A proposal intended to explain certain facts or observations.

Hypothesis Testing: Hypothesis testing is the conclusion based on data.

3.8 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 MR?

7. Why marketing research cannot be considered scientific? Give reasons.

8. Describe the characteristics of scientific method.

Check Your Progress: Model Answer

1. same results

2. scientific instrument

3. continuity

4. attitudes

3.9 SUGGESTED READINGS

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LESSON

4

PROBLEMS IN RESEARCH

CONTENTS

4.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Formulate the research problem
- Find sources of research problem
- 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 vs 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 – For example, 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 and Excise

8. Determination of cost production – procedures and practices

9. Internal audit and control mechanism adopted

10. Mobilisation and 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 four 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 important. 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.

4.15 OBJECTIVITY IN RESEARCH

The purpose of research is to discover new solutions to the problems through the application of scientific procedures. The objectives of any research are broadly studied under two headings, they are:

(a) *Academic in nature:* By manipulating the things, researcher tries to find new propositions or new concepts those results in generalizations and discovery of truth and intimate knowledge which by recording and reporting supplies or adds knowledge to the academicians.

(b) *Utilitarian:* The research tries to render the society by offering solution to the problems it faced based on the principles or theories.

Specifically, the objectives of research are:

1. *To gain knowledge:* Man always tries to gain knowledge over the environment in which he/she is living. It is the human beings instinct to gain knowledge and control over the environment.

2. *To innovate new concepts, theories:* The objective of the research is to try to find new concepts and theories that explain the existing ones or add to the existing ones. In this process, the human endeavour is able to establish new insights that lead to new theories.

3. *To understand, analyze and explore the phenomena:* The exploration to facilitate the new dimensions of the existing and emerging problems. Search facilitates the environment to familiarize the human beings that lead to comfortable life.

4. *To know the cause-effect relationship:* The research tries to establish what cause is and what are effect and its relationships. This type effort leads to satisfaction for the mankind.

5. *To enjoy and improve the society:* The research aim is always facilitate the society to enjoy the benefits of its observations and findings. Knowing more and more things which are generally unknown will lead to purposeful efforts.

Check Your Progress

Fill in the blanks:

1. Retail industries conduct survey on the factors that influence consumers to make their purchase from ....

2. A research problem can be exploratory, ... or causal.

3. .... provide a means of ordering the vast diversity of empherical phenomena.

4. A construct is a concept devised to aid in .... and generalization.

5. A .... is a collection of interrelated concepts.

4.16 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.

4.17 KEYWORDS

Concepts: The terms concepts and constructs though have similar meanings, yet there is some difference between the two.

Construct: A construct is a concept devised to aid in scientific analysis and generalization.

Theoretical Framework: A theoretical framework guides your research, determining what things you will measure, and what statistical relationships you will look for.

4.18 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?

Check Your Progress: Model Answer

1. departmental store

2. descriptive

3. Concepts

4. scientific analysis

5. theoretical framework

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LESSON
5

RESEARCH DESIGN

CONTENTS

5.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Define productivity and productivity cycle
- Understand the macro and micro factors impacting of productivity
- Explain productivity benefit model
- Analyse the productivity at the national level

5.1 INTRODUCTION

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

Research Design in general terms can be referred to as the scheme of work to be done or performed by a researcher during the various stages of a research project.

With the help of the research design, one can very easily handle and operate research work as research design acts as a working plan, which is made by a researcher even before he starts working on his research project. By this, researcher gets a great help and guidance in achieving his aims and goals.

5.2 RESEARCH DESIGN: MEANING AND DEFINITION

A research design encompasses the methodology and procedures employed to conduct scientific research. The design of a study defines the study type that can be descriptive, correlational, semi-experimental, experimental, review or meta-analytic and sub-type for example descriptive-longitudinal case study, research question, hypotheses, independent and dependent variables, experimental design, and, if applicable, data collection methods and a statistical analysis plan.

Like an architect prepares a blue print before he approves a construction – in the same way researcher makes or prepares a plan or a schedule of his own study before he starts his research work. This helps the researcher to save time and also save some of his crucial resources. This plan or blue print of study is referred to as the research design.

Therefore you can say that a research design is a kind of blueprint that you prepare before actually carrying out research. It is a systematically prepared outline stating the manner in which you plan to carry out your research. You may like to contemplate your research in terms of two facets, namely the empirical facet and the analytical facet. The two facets remain in your mind together while in practical terms you may plan your research in terms of a phase of data collection and another phase of analysing the data.

Theoretical orientation and conceptual models in your mind help you decide the kind of data you would collect and to some extent also how you would collect them. Later, while analysing your data, again your theoretical and conceptual understanding of social reality in general will guide you to classify the data and to recognise the pattern in order to explain and present your findings.

Research is an ongoing process consisting of a series of steps, beginning with your identifying various concepts related to your research theme. Once begun, it continues through a set of regulated steps to its conclusion.

5.2.1 Definition

Research design can be defined in many ways. Some of the well-known definitions are summarized as follows:

(a)   It is a conceptual framework under whose umbrella research will be conducted.

(b)   It is a design for collection of measurement and analysis of data

(c) It is a decision matrix which looks into the aspects of 5WH [What, Where, Which, Where & How] as they pertain to a research enquiry.

(d) It can also be defined a mesh of boundary conditions for collection and interpretation of data which in turn leads to efficient conduct of research procedure.

Some of the definitions of research design are given as under:

According to Russell Ackoff, research design is the process of making decisions before a situation arises in which the decision has to be carried out. It is actually a process of deliberate anticipation directed towards bringing an unexpected situation under control.

Russell Ackoff has in a great way explained about the research design in his book 'Designs of Social Research'.

According to David J Luck and Ronald S Rubin, "A research design is the determination and statement of the general research approach or strategy adopted for the particular project. It is the heart of planning. If the design adheres to the research objective, it will ensure that the client's needs will be served.

According to Kerlinger, "Research in the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance. According to Green and Tull, "A research design is the specification of methods and procedures for acquiring the information needed. It is the over-all operational pattern or framework of the project that stipulates what information is to be collected from which source by what procedures.

5.2.2 Significance of a Research Design

Research design provides the researcher opportunity to undertake various research operations smoothly. It makes research as efficient as possible generating maximum information with minimum effort, time and money. It is like blueprint which we need in advance to plan the methods to be adopted for collecting the relevant data and techniques to be used in its analysis for preparation of research project. Researcher has to take all necessary precautions in preparation of the research design, as any error may upset the entire project. The reliability of result, which a researcher is looking, is directly related with research design which constitutes a firm foundation of entire body of research work.

5.2.3 Features of a Good Research Design

The following are the main features of a good research design:

1. *Simplicity:* It should be simple and understandable

2. *Economical:* It must be economical. The technique selected must be cost effective and less time-consuming

3. *Reliability:* It should give the smallest experimental error. This should have the minimum bias and have the reliability of data collected and analysed.

4. *Workability:* It must be workable. It should be pragmatic and practicable.

5. *Flexibility:* It must be flexible enough to permit the consideration of many different aspects of a phenomenon.

6. *Accuracy:* It must lead to accurate results.

5.2.4 Elements of a research design

The important elements of a research design are as under:

1. A specification of the sources and kind of information needed for conducting research

2. A strategic roadmap that will be deployed for collecting and analyzing data

3. A definition of both time lines and cost estimates since most research studies operate under these constraints.

5.3 DIFFERENT CONCEPTS IN RESEARCH DESIGN

The different concepts of a research design can be stated as under:

1. *Dependent and independent variable:* A concept which cannot stay the same or can take different quantitative values like weight, height, income etc. is called a variable. It can be any attributes which qualify on the basis of its presence or absence.

    The quantitative phenomena that can take different values even in decimal points are called „continuous variables. Some of the phenomena can only be expressed in integer values called „discrete variables, for example, age of children is continuous variable whereas number of children is discrete variable.

    If one variable depends upon the other variable, it is called dependent variable and the variable that is antecedent to the dependent variable is called independent variable. For example if we say that height depends upon age and sex then height is a dependent variable and age and sex is an independent variable.

2. *Extraneous variable:* Some independent variables that are related to the research study but may affect the dependent variable are called extraneous variables. In any investigation if the effect is noticed, it is technically termed as „experimental error. It is advised that a study must be designed in such a manner that the effect upon the dependent variable is attributed entirely to the independent variables not to extraneous variable.

3. *Control:* In experimental researches, when we design the study minimizing the influence of extraneous independent variables, which is termed as „control. Control is important characteristic of a good research.

4. *Confounded relationship:* In experimental research, the dependent variable is not free from effect of extraneous variables. This type of relationship between dependent and independent variables is called confound relationship.

5. *Experimental and non-experimental hypothesis-testing research:* If the purpose of research is to test a research hypothesis, it is called hypothesis testing research. It can be of experimental or non-experimental in nature. Experimental hypothesis testing research is one in which the independent variable is manipulated. If it is not possible it is called non-experimental hypothesis-testing research.

    In case, experimental testing is not possible then researcher conducts what is known as non-experimental hypothesis testing research. An example of this is, suppose a researcher wants to study whether height of an athlete affects the performance at pole-vault competition. For this purpose, he can randomly select, say 30 athletes and measure their height and their performance at pole-vault competition. He can then draw conclusion about the hypothesis hy calculating the coefficient of correlation between the heights.

6.   Experimental units: In any research, researcher has to define the pre-determined block very carefully where different treatments are used. These blocks are called experimental units.

5.4 STEPS IN A RESEARCH DESIGN

Stated in simple language, a research design is a plan of action, a plan for collecting and analysing data in an economic, efficient and relevant manner. Whatever be the nature of design, the following steps are generally followed.

1.   *Selection and Definition of a problem:* The problem selected for study should be defined clearly in operational terms so that researcher knows positively what facts he is looking for and hat is relevant to the study.

2.   *Source of Data:* Once the problem is selected it is the duty of the researcher to state clearly the various sources of information such as library, personal documents, field work, a particular residential group etc.

3.   *Nature of Study:* The research design should be expressed in relation to the nature of study to be undertaken. The choice of the statistical, experimental or comparative type of study should be made at this stage so that the following steps in planning may have relevance to the proposed problem.

4.   *Object of Study:* Whether the design aims at theoretical understanding or presupposes a welfare notion must be explicit at this point. Stating the object of the study helps not only in clarity of the design but also in a sincere response from the respondents.

5.   *Social-Cultural Context:* The research design must be set in the social-cultural context. For example in a study of the fertility rate in a people of „backward class the context of the so-called backward class of people and the conceptual reference must be made clear. Unless the meaning of the term is clearly defined there tends to be a large variation in the study because the term backward could have religious, economic and political connotations.

6.   *Temporal context:* The geographical limit of the design should also be referred to at this stage that research related to be hypothesis is applicable to particular social group only.

7.   *Dimension:* It is physically impossible to analyze the data collected from a large universe. Hence the selection of an adequate and representative sample is a by-word in any research.

8.   *Basis of Selection:* The mechanics of drawing a random, stratified, and purposive, double cluster or quota sample when followed carefully with produce a scientifically valid sample in an unbiased manner.

9.   *Technique of Data Collection:* relevant to the study design a suitable technique has to be adopted for the collection of required data. The relative merit of observation, interview and questionnaire, when studied together will help in the choice of suitable technique. Once the collecting of data is complete, analysis, coding and presentation of the report naturally follow.

5.5 OBJECTIVITY IN A RESEARCH DESIGN

A study in which the subject matter is the center of attention and prejudices are given no place is known objective study. Objectivity is scientific observation, collection and analysis

of data without prejudices and attachments. In an objective study the subject matter is observed and described as it is without exaggeration or diminution. In an objective study the investigator should use only his sense organs and brain and not feelings and beliefs. Even if his feelings may be against the results of an investigation, he should accept it if they have heen achieved through scientific procedure. Reasoning and intellect are most important than belief and faith in an objective study. It gives priority to fact as against fictions.

5.5.1 Need of Objectivity

Objectivity is a must in order to arrive at general and universal conclusions in a scientific study. The following points highlight the need of objectivity.

1. *To make research design scientific:* to make the research design scientific it is essential that questionnaires, schedules and statistical methods and metric scales are used.

2. *To make scientific conclusions:* Every research aims at scientific conclusions. Scientific conclusions are not influenced by imaginations, feelings, prejudices and impressions etc. They are based on facts and reasoning.

3. *To achieve representative Facts:* In order to get representative samples from objectivity point of view, it is essential that the sample must be selected scientifically.

4. *For verification:* Verification is a necessary condition in a scientific study of the facts and conditions. The conclusions must be verified by repeated studies of the identical phenomenon through identical method in identical circumstances. These repeated studies eliminate the elements of errors in conclusion so that they now assume the form of principle or law. Objectivity is a must for verification of the results.

5. *For actual study of the phenomenon:* Objectivity is a must for actual study of the phenomenon. If the investigator has an objective attitude he may arrive at conclusions which may be universally accepted.

6. *In order to know the possibilities of fresh research:* Objective study shows new possibilities of research. The objective study aims at discovery of unknown facts. It helps in finding out aspects which may be explored through independent research

5.5.2 Difficulties in Objective Research

The following are the main difficulties encountered in Objective Research

1. *Difficulty of detachment of the investigator:* The biggest problem before the investigator is to keep him detached from the subject of study. These are impediments in keeping the research study objective and scientific.

2. *Influence of popular Notions:* The current notions of the business may act as impediments in the objectivity of research study.

3. *Fallacy of particularity:* An impediment in the objectivity of research studies is the fallacy of particularity. For example to say that the only one cause of indiscipline among workers is the union activism is to commit this fallacy since union activism is only one factor in indiscipline and it may not be applicable in the case of every worker.

4. *Confusion of General Knowledge with actual knowledge:* An objective study aims at actual knowledge and not general knowledge. Sometimes an investigator

confuses the general and current knowledge with real knowledge. This dependence over general knowledge is a serious impediment in the objectivity of the study.

5. *Possibility of contradictory prejudices:* In order to decide over a managerial issue one may be either in favour or against it. This, however, makes the attitude prejudicial.

6. *Ethnocentrism:* it means favouring of the race, caste group, society, community, religion, culture, language and literature of which one is a member and follower. Thus ethnocentrism is a serious prejudice in one's own favour and against others.

7. *External pressures:* External pressures seriously interfere with the objectivity of research studies.

8. *Personal Interests of the investigator:* If the interests of the investigator are in some way connected with the problem of study, there is no possibility of objectivity. If the collection and publication of the fact may harm his interests, the investigator will make all possible efforts to restrict their collection and publication.

9. *Absence of quick judgment:* In some studies there is an urgent need of quick judgment. However, in such situations the judgment is hardly objective, and becomes one of the impediment.

10. *Attitude and prejudices:* The attitudes and prejudices are the most important impediments in objectivity of the study. While there is no fear in adopting objective attitude towards physical phenomenon, one has to face several types of fears in adopting an objective attitude in social studies. This fear may be due to the state, clan, the family or the group and is likely to create adverse influences, which are impediments in the objectivity of study.

5.5.3 Means of Objectivity or Methods of Achieving Objectivity

The following means may be useful in achieving objectivity in research studies:

1. *Use of experimental Methods:* Experimental method helps in achieving objectivity in study. The statistical and quantitative techniques are used to arrive at conclusions. These methods have no place for personal ideas, feelings, ideals, values and impressions. The experimental method is universal and democratic. It involves verification and re-verification. Therefore, it is a useful means to arrive at objectivity in research studies.

2. *Standardization of Technical terms and concepts:* In order to achieve objectivity in research studies, the terms, concepts used must be definite and clear. No term should be used in more than one sense. In order to facilitate this process, each technical term and concept should be rendered definite and clear before its actual use. This standardization of terms and concepts will provide objectivity to research studies.

3. *Use of questionnaires and schedules:* Questionnaires and schedules are used in research studies to avoid personal prejudices and bias. These are considered as one of the best methods of observation. However, these methods have also some serious limitations.

4. *Use of Random Sampling:* The objectivity of research studies very much depends upon selection of representative samples. If the investigator selects the samples according to his own inclination they are generally defective. In order to avoid this problem, random sampling is widely used in research studies.

5. *Use of Group Instigation Techniques:* Most of the defects in research studies are due to personal and subjective factors of the investigator. In order to eliminate this element of error, a research problem is now studied not by one investigator, but by a group of investigators. This technique of group study eliminates the personal factors connected with different investigators.

6. *Use of Control methods:* There is a positive correlation between the amount of control and the objectivity of methods in social sciences.

7. *Use of Mechanical Tools:* In order to eliminate the personality or mental factors and to remove the source of error it is useful to utilize more mechanical tools such as typewriter, tape-recorder, photo cameras etc.

8. *Use of Inter Disciplinary method:* Besides, mental or psychological, the research problems have economic political, religious, cultural and so many other aspects. As well since all these aspects are interrelated, it is necessary to know all these in order to arrive at a complete knowledge of problem. For this purpose inter-disciplinary method is used. If the inter-disciplinary method is faithfully followed, it leads to high amount of objectivity in research studies.

5.6 SOURCES OF PREJUDICES AND BIASES

Following is the systematic list of biases likely to occur in research design;

1. *Bias of observer:* While observing any phenomenon we are liable to concentrate on some facts and miss or ignore others due to our built-in value system, preconceptions, interest and sentiments. But a good observer must see facts as they are and not as he wishes to see them. He must see all relevant details and suspend his personal judgment while he is observing.

2. *Bias of Informers:* In design research, a researcher has to collect facts by making queries from people. They usually avoid answers which are likely to be controversial. Sometimes they supply wrong answers because they do not quite understand the question. In order to avoid these pitfalls, a research must be able to approach his informers, tactfully, create confidence in them and make them realize the value of their cooperation.

3. *Bias due to Sample:* A research can be meaningful and useful only if we choose a representative sample for investigation. A haphazard and careless choice of samples can seriously prejudice the cause of research.

4. *Defective Questionnaire:* The quality of answer is dependent upon the quality of questions. If questions are ambiguous and capable of being understood variously the answers will be indefinite and unreliable. Therefore while formulating a questionnaire; adequate care should be taken to include only unambiguous and clear questions.

5. *Defective Data Collection:* The validity of research is determined by the validity and correctness of data collected. Only trained workers are capable of avoiding errors in the collection of data.

6. *Defective Analysis:* After collection of data, appropriate analysis is the next requisite. Only if the analysis is proper there can be hope for valid conclusions. In this connection special attention must be paid to proper classification of data.

7. *Defective Generalization:* Having analyzed the data, valid generalization becomes possible. Personal bias in any form can vitiate the conclusions; hence one must be completely objective in deriving conclusions from the facts before oneself.

8.   *Sentiment Factors:* While the research in physical sciences hardly produces any emotional reverberations in the scientists, the observer of social events is emotionally affected by them. By training only such prejudices can be minimized.

9.   *Common Sense Bias:* Usually have a number of common sense notions regarding social facts, events and process. These built-in notions in our mind many a times prevent us from perceiving the scientific truth. Built-in prejudices in our mind close our minds to fresh ideas. By training of mind only it is possible to reject what does not fit in with its existing system of ideas.

10.   *Bias Due to Attitude and Aptitudes:* We see things in the light of our own point of view. We may very well miss what we not want see. A well trained researcher keeps his judgment always suspended and even when certain findings are highly unpalatable to him personally he refuses to distort the facts.

11.   *Time factors in Research:* The general maxim that hurry makes worry and haste makes waste applies very much to research. If under the pressure of practical need or lack of time a researcher formulates his basic hypothesis in a hurry and does not devote adequate time to data collection, analysis etc, his conclusions will not be very reliable as the probability of errors in his source remains. As a matter of fact undue hurry as well as undue delay is prejudicial to a good research.

5.7 TYPES/FORMS OF A RESEARCH DESIGN

Research design may be for the convenience of study, categories and the following heads:

1.   Exploratory or formulative design

2.   Descriptive or diagnostic design

3.   Experimental design

5.7.1 Exploratory or Formulative Design

Another name for exploratory research is formulative research studies. Since the basic purpose of such studies is to discover new ideas or insights, research design in such studies should be more flexible. The need for such flexibility is because in exploratory or formulative research the problem is loosely defined as it is the process of exploratory studies that would lead to more focus on the specific research area. Generally, the formulative or exploratory research leads to a more precise definition of the research problem and at times also necessitates changes in research methodology and paradigm for data collection.

Characteristics of Exploratory Design

The exploratory design must process the following characteristics:

1.   *Business Significance:* Unless the problem has a place in the industry or has business significance, its study shall be useless and meaningless.

2.   *Practical Aspect:* If should be of practical value to the management. If it has not practical value it shall be useless for business decisions.

3.   *Combination of Theory:* Mere practical significance of the problem has no meaning unless it is based on theory. If a particular problem is based on certain theoretical aspects it shall be possible for the researcher to judge its utility or proceed with his study in the right direction.

4. *Reliable and valuable facts:* In the absence of reliable and valuable facts, the study of the problem shall be no managerial significance

Role/Significance of Exploratory Design

Its role can be emphasized owing to following aspects:

1. *Information about the immediate conditions:* The design provides information about the conditions of the problem. When the investigator does not have resources and capability to test the hypothesis he is able to find facts through exploratory design which is suitable to or in accordance with the hypothesis.

2. *Presentations of Important Problems:* Through exploratory and formulative designs, it is possible to present important research problems. Once the problems have been presented, the investigator is automatically attracted towards the study of the problem that has greater importance for our society.

3. *Study of the unknown fields:* For research, theory or hypothesis is inevitable. They provide proper basis. In order to formulate a hypothesis, we have to acquire the relevant information and through exploratory design this task is achieved.

4. *Theoretical Base:* The research problem deals with our social life and social problems and data about them can only be collected through exploratory design. This design is helpful in providing a theoretical base to the hypothesis and theories.

5. *Presentation of uncertain problem for study in research:* Through exploratory designs we are able to determine these problems. This method on the one hand, focuses the attention of the investigator on the problem and, on the other; it helps him to collect facts on scientific lines so that research may be carried out correctly.

Methods of Exploratory Research Design

Generally the following three methods are adopted:

1. *Review/Survey of the Concerned Literature:* When the investigator proceeds on the path of research he has to take advantage of his predecessors. He has also to take help from what has already been done. This would save him from the trouble of trial and error, and also economize his efforts. There are various hypothesis available. From these hypotheses, the investigator has to select those that are useful to him. Review and perusal of pertinent literature is very useful to him. Apart from literature directly connected with the problem, the literature that is connected with similar problems is also useful for him. It helps in the formulation of the problem in a clear-cut manner.

2. *Experience Survey:* As the name suggests, it implies seeking experiential learning from the people who have practically dealt with the research problem at hand. It is important that for such a survey only such people who are well versed in the area of research and have mental ability to contribute new ideas and suggestions are selected as respondents. It is important as objective of such a survey is to find new insights between the research variables and the new ideas that may impinge on solution of such a problem. The respondents who are selected for such a survey are interviewed by the researcher on the basis of a carefully prepared interview schedule. Therefore, experience survey enables an investigator to define the research problem more concisely and also assists in hypothesis formulation.

3. *Analysis of insight stimulating cases:* Case based research decision is particularly needed for such research areas where there is very little prior experience. The

approach that is needed for such methodology is to put together test cases which embody those events, incidences and phenomena that have direct bearings on the research problem. Such cases can he put together through a process of examining records, unstructured interviewing and researchers observations. Therefore, it is important that the research has the aptitude, attitude and insight to put together diverse information into a case which can be further interpreted in order to provide bearings and solutions of the research problem.

The following are the important factors which affect the study:

1. *Attitude of the investigator:* in the study of the case or the case study attitude of the investigator is very important. If the attitude of the investigator is receptive and he is sensitive to various developments that take place in the field of his study he is able to make a steady progress. As a result of his receptivity he does not concentrate merely on the available data, but also take notes of the peculiarities and specialties of the subject of the study or case study. As a result of this study continues to change according to available information. Because of new hypothesis the investigator also changes the standards and the measurements of the case study selection and collection of the material.

2. *Intensity of the case study:* The next characteristic of the case study is the intensity of its study. Under case study method, the subject matter is studied in all its dimensions and ramifications. Such a study is not limited to the present alone, but is done in the background of the historical business/industry/firm's background.

3. *Integrative Powers of the Investigator:* The third factor that stimulates the investigator is his integrative power. On this basis he collects even the minutest possible information about the subject matter.

Generally, the following types of events are able to stimulate the investigator:

1. *Reaction of strangers:* When we want to study the characteristics of a particular group or community, the reactions of the strangers are very valuable. Reactions of the strangers throw more light on the characteristics of a community and present more reliable and dependable picture of the society.

2. *Transitional Cases:* Such problems that have transitional nature or those problems that continue to progress from one stage to the other are very stimulating for the investigator.

3. *Landmark cases:* The landmark cases in fact are responsible for industry development and they are bound to be stimulating and interesting for the investigator.

4. *Characteristics of the industry:* The characters of the industry throw light on the industrial conditions. Apart from it, they are also of interest and insight stimulating for the investigator.

5. *Position in different industry structures:* In an industry there are firms that represent different stages of maturity. These organizations represent the outlook and the characteristics of these industry structures, and stimulate the investigator to conduct the research.

5.7.2 Descriptive and Diagnostic Design

Descriptive research studies are those studies which make specific predictions regarding the outcome of research issue along with the descriptions of facts and other characteristics concerning the research sample or situations.

On the other hand, diagnostic research studies look into the fact whether certain research variables have a causal association with other phenomena. In brief, diagnostic are based on cause and effect studies.

Difference between Descriptive and Diagnostic Designs

The difference between the two studies lies mainly in regard to the following:

1. *Difference in field:* Basically the diagnostic design of research is concerned with the express characteristics and existing social problems. It tries to find out relationship between the express cause and presents a diagnostic action. Contrary to this the descriptive designs are concerned only with the existing or present forms of the problem. It begins with the research about past form of the problem. It does not bother about the diagnostic approach or activities. Diagnostic designs study the real form of the problems and they also suggest ways and means for their solution.

2. *Difference in Hypothesis:* Diagnostic designs are entirely motivated by the hypothesis. On the other hand, the descriptive designs are not entirely motivated and guided by the hypothesis. In descriptive designs, hypothesis is formulated on the basis of the description of the existing data or material. On the other hand, in diagnostic designs the material is collected on the basis of the formulated design.

3. *Difference in Objective:* From the point of view of objectives, Diagnostic design is based on such knowledge which can also motivate or put into practice in the solution of the problem. Thus the diagnostic design is equally concerned with the case as well as the treatment. But in descriptive design the main object is to acquire knowledge. It has nothing to do with the solution of the problem or treatment of the causes.

4. *Treatment:* Under the diagnostic design immediate or timely solution of the cause elements or cause is necessary. The investigator, before studying other references, tries to remove and solve the factors and the causes that have given rise to the problem. It is the main cause that brings about the development of the problem that is studied by the investigator in the diagnostic design. But under descriptive designs, no attempt is made to solve or modify the existing or present causes of the problem.

5. *Difference in the field expansion:* There are certain fields where the knowledge about the problem has not been developed properly. In such circumstances, descriptive designs are more useful and effective as compared to diagnostic designs. In spite of these differences, descriptive and diagnostic designs are very intimately related to one another. Whenever a problem is to be studied, characteristics and elements of both these designs have to be taken into account and put to use. In other words, it may be said that the difference is only for convenience of study. In actual practice, both these designs have a contribution, and their elements have to go together.

5.7.3 Experimental Designs

Experimental design implies the options in design the research experiments to lead to possible outcomes on the research problem, which can lead to possible solution of the research problem. Experimental design is generally classified into two categories:

1. Informal experimental design

2. Formal experimental design

Informal experimental design is generally based on „thumb rule rather than extensive scientific analysis. On the other hand, formal experimental design needs precise statistical procedure for both design and analysis.

To achieve the goal of process optimization, to prevent, or to minimize the occurrence of defective product, a thorough understanding of the process behavior under different sets of process conditions is needed. This can be best obtained through designed or planned experimentation. Planning an experiment so that conformation relevant to the problem on hand will be made available is known as: Designing and experiment.

Experience has shown that if the data collection is properly planned, organized, summarized and interpreted using statistical principles, one will be able to draw valid and meaningful conclusions from the results. The design of experiment was found to be an excellent tool of effecting engineering development, quality improvement, process optimization as well as cost reduction.

In general, planned experimentation is necessary to distinguish between critical factors (which have a dominating) effect and need to be controlled within the narrow limits and non-critical factors which are insignificant and do not require close control as well as to identify the optimum levels of the critical factors so as to achieve significantly improved performance.

Steps in Planning an Experimental Design

Planning of an experiment is sine quo non for successful conduct of the experiment. The following steps are adopted in planning an experimental design.

1. *Selection of the Problem:* Every problem cannot be studied through experimental method. One of the major conditions being the capacity to manipulate the independent variable the effect of which is decided to be studied. For instance, study of various advertising techniques, training methods, effect of group decision, political propaganda are some of the illustrations of problems that have been studied through experimental design.

2. *Proper Description of the selected problem:* After selecting the problem it must be put in proper language, i.e., the hypothesis must be stated in clear and conceptual terms. The variables that affect the phenomenon must be known and conceptualized. The fundamental causative factor or the independent variable must also be decided and the plans for its gradual manipulation must be clearly determined.

3. *Selecting the settings:* The background in which the experiment relating to phenomenon is to be carried out is termed as setting. In case of laboratory experiment it is created artificially and the experimenter decides how it can be done. In case of a field experiment, natural setting has to be located where the experiment can be made.

4. *Pilot Study:* In planning an experiment, a pilot study may be necessary so that the researcher is brought face to face with realities and many problems that he had not thought of. This also will enable him to know more precisely the various causative factors involved, the nature and working of the institution, the extent of co-operation or resistance that he is expected to meet. A researcher becomes prepared, through this, to discuss the plan of experiment, and its object with the key persons to seek their cooperation.

5. *Research Design:* The most vital part of the research is research design as it lays down the manner in which the researcher will manipulate the situation in order to study the desired effect. This in itself leads to problem or control over the phenomenon. For a successful experiment it is necessary that the major independent variable should be varied gradually while all other causative factors should remain unchanged.

Experimental design is the basic framework or structure of an experiment on which the whole research work is focused. There are two broad classification of experimental design: formal experimental designs and informal experimental designs. The formal experimental designs offer the researcher more control and use of precise statistical procedures for analysis of the study whereas informal experimental designs normally use less sophisticated form of statistical procedures for analysis. The important experimental designs are as follows:

1. Informal experimental designs

    a. Before-and-without control design

    b. After-only with control design

    c. Before-and-after with control design

2. Formal experimental designs

    a. Completely randomized design (CR Design)

    b. Randomized block design (RB Design)

3. Latin square design (LS Design)

4. Factorial designs

Check Your Progress

Fill in the blanks:

1. ....is a conceptual framework under whose umbrella research will be conducted.

2. A concept which cannot stay the same or can take different quantitative values like weight, height, income etc. is called a..............................

3. The quantitative phenomena that can take different values even in decimal points are called............................

4. Some independent variables that are related to the research study but may affect the dependent variable are called ....

5. The research design must be set in the ....

5.8 LET US SUM UP

In this lesson the dentitions of Research Design, Dependent and independent Variables extraneous variables, control, confounded Relationship, Research Hypothesis, Experimental and non-experimental hypothesis testing research, experimental and control Groups, treatments, experiment, and experimental unit, have been explained.

The need or significance of research design has been highlighted. Features of a good research design have been included. Steps or procedure, of a research design have been described. Problem of objectivity and its need in research design has been incorporated. The difficulties in objective research and means of achieving objectivity in research design have been explained.

The various types of research design have been described. Exploratory or formulative design, its characteristics and significance have been discussed. The methods of

exploratory design, i.e., Review/Survey of Literature, Experience Survey, and Analysis of insight stimulating cases have been explained. Descriptive and diagnostic designs have been discussed. The difference between descriptive and diagnostic design has been described. The motivating events for investigation have been included.

5.9 KEYWORDS

Continuous variable: The quantitative phenomena that can take different values even in decimal points.

Extraneous variables: Some independent variables that are related to the research study but may affect the dependent variable.

Research Design: In in general terms it can be referred to as the scheme of work to be done or performed by a researcher during the various stages of a research project.

Varial le: A concept which cannot stay the same or can take different quantitative values like weight, height, income etc.

5.10 QUESTIONS FOR DISCUSSION

1.   What is research design? Explain its importance

2.   Explain the features of a good research design and describe the steps of conducting a research design.

3.   What is objectivity? State its need in Research design

4.   Explain the difficulties of objective Research. How objectivity can be achieved in a research design.

5.   Explain the sources of prejudice and bias in a research design

6.   Explain the exploratory or formulative research design and describe its characteristics.

7.   Distinguish between exploratory and descriptive research design Distinguish between experimental and non-experimental research design

8.   Explain the role of exploratory research design

9.   Describe the methods of exploratory research design

10.   Differentiate between experience survey and analysis of insight stimulating cases.

11.   Describe the motivating events for the investigators

12.   Explain the difference between exploratory design and descriptive and diagnostic designs.

Check Your Progress: Model Answer

1.   Research design

2.   Variable

3.   Continuous variable

4.   Extraneous variable

5.   Socio-cultural context

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LESSON

6

HYPOTHESIS

CONTENTS

6.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Define hypothesis
- Describe source of hypothesis
- Distinguish between different types of hypothesis
- Formulate research design type
- Describe different methods of exploratory research

6.1 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.

6.2 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.

6.3 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:

   (a) Public enterprise has greater social concern than other enterprises.

   (b) Peoples perception of government enterprise is social concern.

   (c) 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 he 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.

6.4 TYPES OF HYPOTHESIS

There are several basis on which hypothesis are classified:

(a) Descriptive Hypothesis

(b) Relational Hypothesis

6.4.1 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.

6.4.2 Relational Hypothesis

In this case, we describe relationship between two 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.

6.4.3 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.

6.4.4 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.

6.4.5 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.

6.4.6 Statistical Hypothesis

These are got from samples that are measurable. Statistical hypothesis are of two 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.

6.4.7 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.

6.5 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. For 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.

6.6 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. For 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. For 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.

6.7 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. Sometimes, 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 develop d 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.

6.8 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

6.8.1 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. For 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.

6.8.2 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.

6.8.3 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. For 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. For 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.

6.8.4 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.

6.9 CONCLUSIVE RESEARCH

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 Causal 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". For example, 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. For 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

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 two 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, sometimes, 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.

- Sometimes 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.

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.

Check Your Progress

Fill in the blanks:

1. A hypothesis is a tentative proposition relating to ....

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

3. Cross sectional study is one of the most important types of ....

4. .... is framed in the early stages of research.

5. Longitudinal studies involve ....

6.10 LET US SUM UP

The lesson, 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 two 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."

6.11 KEYWORDS

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

Null Hypothesis: Null hypothesis states that there is no difference between the parameter and the statistic that is being compared.

Focus Group: In focus group, a small number of individuals are brought together to study and talk about some topic of interest.

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

6.12 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?

Check Your Progress: Model Answer

1. certain phenomenon

2. null hypothesis

3. descriptive research

4. Working hypothesis

5. panels

6.13 SUGGESTED READINGS

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LESSON

7

CAUSAL RESEARCH

7.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

● Understand what is causal research

● Solve the research problem systematically

● Describe different types of experimental designs

7.1 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.

7.2 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. For 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.

1. Sometimes, marketing manager wants to draw certain conclusions such as:

    (a) Impact of retail price on sales

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

    (c) Effect of improved packing on sales.

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

    Examples of experimentation:

    (a) Which print advertisement is more effective? Is it front page, middle page or the last page?

    (b) Among several promotional measure, such as advertisement, personal selling, "which one is more effective"?

    (c) Can we increase sales of our product by obtaining additional shelf space?

2. 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:

Input	Output
Test units	
Explanatory variable (Independent variable)	Dependent variable
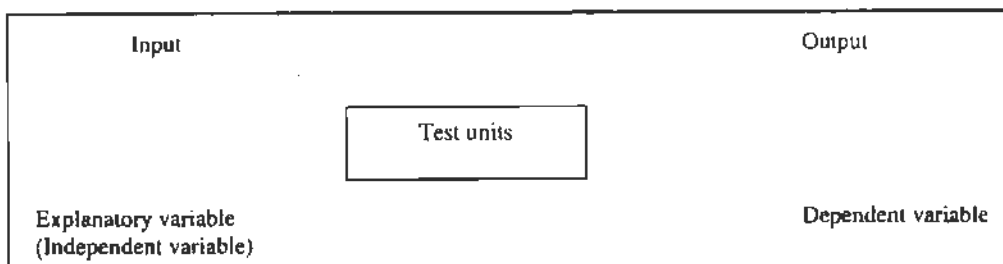
7.2.1 Test Units

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.

7.2.2 Explanatory Variable

These are the variables whose effects, researcher wishes to examine For example, explanatory variables may be advertising, pricing, packaging etc.

7.2.3 Dependent Variable

This is a variable which is under study. For 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.

7.2.4 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. For 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.

7.3 TYPES OF EXTRANEOUS VARIABLES

The following are the various types:

- History
- Maturation
- Testing

- Instrument variation
- Selection bias
- Experimental mortality

7.3.1 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. For 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.

7.3.2 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.

7.3.3 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.

7.3.4 Instrument Variation

Instrument variation effect is a threat to internal validity when human respondents are involved. For 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.

7.3.5 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' hought 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.

7.3.6 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.

7.4 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.

7.5 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: It 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.

7.6 EXPERIMENTAL DESIGNS

The various experimental designs are as follows:

- After only design
- Before-after design
- Factorial design
- Latin square design
- *Ex-post facto* design

7.6.1 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.

7.6.2 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.

7.6.3 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 A_1 and reduced price A_2. Let there be three types of POP namely B_1, B_2, & B_3. There are $3 \times 2 = 6$ combinations possible. The combinations possible are B_1A_1, B_1A_2, B_2A_1, B_2A_2, B_3A_1, B_3A_2. 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.

7.6.4 Latin Square Design

Researcher chooses three 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 three 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.

7.6.5 *Ex-post 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.

Check Your Progress

Fill in the blanks:

1. Causal research establishes cause and effect relationship between the ....

2. Extraneous variables are also called as ....

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

4. Instrument variation effect is a threat to .... when human respondents are involved.

5. .... permits the researcher to test two or more variahles at the same time.

7.7 LET US SUM UP

This lesson 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 three 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 lesson, system approach to research design is diagrammatically shown.

7.8 KEYWORDS

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

Maturation: Maturation is similar to history. Maturation specifically refers to changes occurring within the test units and not due to the effect of experiment.

Instrument Variation: Instrument variation effect is a threat to internal validity when human respondents are involved.

Factorial Design: Factorial design helps to determine the effect of each of the variables and also measure the interacting effect of the several variables.

7.9 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 variables? 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?

Check Your Progress: Model Answer

1. variables

2. blocking variables

3. Concomitant variable

4. internal validity

5. Factorial design

7.10 SUGGESTED READINGS

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LESSON

8

CONCEPT OF MEASUREMENT

CONTENTS

8.0 Aims and Objectives

8.1 Introduction

8.2 Features of a Good Design

8.3 Meaning of Measurement

8.4 Errors in Measurement

8.5 Tests of Sound Measurement

8.6 Techniques of Measurement

8.7 Sample Questionnaire Items for Attitude Measurement

8.8 Let us Sum up

8.9 Keywords

8.10 Questions for Discussion

8.11 Suggested Readings

8.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

● Understand meaning of and error in measurement

● Construct sample questionnaire for attitude measurement

● Know basic techniques of measurement

8.1 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.

8.2 FEATURES 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.

8.3 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.

8.4 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.

8.5 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.

8.6 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.

8.7 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

Fill in the blanks:

1. .... is a process of mapping aspects of domain into other aspects of a range according to some rule of correspondence.

2. Validity can also be thought of as ....

3. Measurement can be made using nominal, ..., interval or ratio scale.

4. Measurer errors may also creep in because of ...., tabulation, statistical calculation etc.

8.8 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.

8.9 KEYWORDS

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.

Reliability: Reliability means, measuring instrument should provide consistent results, even if it is measured repeatedly.

Practicality: It means measuring instrument must be economical and easy to use by the researcher.

Instrument: Instruments means tools used for measurement is also a source of error.

8.10 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?

Check Your Progress: Model Answer

1. Measurement

2. utility

3. ordinal

4. faulty analysis

8.11 SUGGESTED READINGS

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LESSON

9

SCALING TECHNIQUES

9.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Describe four widely accepted measurement scales

- Construct various scales

9.1 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.

9.2 TYPES OF SCALE

(a)   Nominal scale

(b)   Ordinal scale

(c)   Interval scale

(d)   Ratio scale

9.2.1 Nominal Scale

In this scale, numbers are used to identify the objects. For example, 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.

9.2.2 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.

9.2.3 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.

1 hr. 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.

9.2.4 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.

9.3 SCALE CONSTRUCTION TECHNIQUES

The following scales are measuring the attitude:
- Paired comparison
- Likert scale
- Semantic differential scale
- Thurstone scale

9.3.1 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.

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

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

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.

9.3.2 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.

9.3.3 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

9.3.4 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: 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 of Thurstone Scale

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

Check Your Progress

Fill in the blanks:

1. Ordinal scale is used for .... in most market research studies.

2. In .... numbers can be interchanged.

3. Ratio scale is a special kind of internal scale that has a meaningful ....

4. .... is called as summated rating scale.

5. .... also known as equal appearing interval scale.

9.4 LET US SUM UP

Lesson 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 lesson 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 three methods to check the validity which type of validity is required depends on "What is being measured".

9.5 KEYWORDS

Ordinal Scale (Ranking Scale): 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.

Ratio Scale: Ratio scale is a special kind of internal scale that has a meaningful zero point.

Semantic Differential Scale: It consists of number of items to be rated by the respondents.

9.6 QUESTIONS FOR DISCUSSION

1. What are the four 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?

Check Your Progress: Model Answer

1. ranking

2. nominal scale

3. zero point

4. Likert scale

5. Thurstone scale

9.7 SUGGESTED READINGS

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

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LESSON
10

SAMPLING DESIGN

CONTENTS

10.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Define sampling
- Describe steps involved in the sampling process
- Distinguish between different types of sampling design
- Describe various probability and non-probability sampling techniques

10.1 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.

10.2 MEANING AND CONCEPTS OF SAMPLE

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

10.2.1 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. For example, telephone directory, product finder, yellow pages.

10.2.2 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. For 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. For example, reaction to global advertising by a company.

10.3 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 10 to May 10, 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 defming 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.

10.4 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.

10.5 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.

10.5.1 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 four 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 three 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 two possibilities (1) Equal probability (2) Varying probability.

(a) *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.

(b) *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 three steps:

1. Sampling interval K is determined

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

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.

Solution:

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

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.

Illustration 1:

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.

Solution:

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]

∴ Proportionate sampling

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

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

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

n_1 is the sample size to be drawn from stratum 1

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

Illustration 2: 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 σ_i is the variance of the stratum i,

where $i = 1,2,3\ldots\ldots k$.

The formula to compute the sample size of the stratum i is the variance of the stratum i, where size of stratum i

r_i = Sample size of stratum i

$$r_i = \frac{N_i}{N}$$

r_i = Ratio of the size of the stratum i with that of the population.

N_i = Population of stratum i

N = Total population.

Illustration 3: 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 these 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 region.

Solution:

Total Population $\qquad N = 1500$

Size of the stratum 1, $\qquad N_1 = 600$

Size of the stratum 2, $\qquad N_2 = 500$

Size of the stratum 3, $\qquad N_3 = 400$

Variance of stratum 1, $\qquad \sigma_1^2 = 64$

Variance of stratum 2, $\qquad \sigma_2^2 = 25$

Variance of stratum 3, $\qquad \sigma_3^2 = 16$

Sample size $\qquad n = 100$

Stratum Number	Size of the stratum N_i	$r_i = \dfrac{N_i}{N}$	σ_i	$r_i \sigma i_o$	$r_i \sigma i_o = \dfrac{r_i \sigma i_o}{\sum_i r_i \sigma_i}$
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 ($2 \times 250 = 500$) 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.

10.5.2 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:

Classification of Sample

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.

10.6 DISTINCTION BETWEEN PROBABILITY SAMPLE AND NON-PROBABILITY SAMPLE

10.6.1 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 and cluster sample.

10.6.2 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 and judgment sampling.

Illustration 4: 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. $z_\alpha = 2.576$ (at 1% l.o.s)

(Table value)

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

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

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

Illustration 5: 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

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

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

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

$$n = 10.57 ; 11$$

Illustration 6: Determine the sample size, if sample proportion p = 0.4 & standard error of proportion is 0.043.

Solution:

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

We know that

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

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

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

$$= 129.79 ; 130$$

Illustration 7: 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 $\mu = 43$, $\overline{X} = 45$

$$\sigma = 8.66; \quad z = 5\% \text{ l.o.s}$$

$$\Rightarrow \quad z_\alpha = 1.96$$

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

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

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

Check Your Progress

Fill in the blanks:

1. Sampling frame is the list of elements from which the sample is ....

2. In probability sample, every unit in the population has .... chances for being selected as a sample unit.

3. Equal probability is called as random sampling with ....

4. Deliberate or purposive sampling is also called ....

5. Sequential sampling is a method in which sample is formed on the basis of a series of ....

10.7 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 two 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.

10.8 KEYWORDS

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

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 have unequal or zero chances for being selected as a sample unit.

Proportionate Stratified Sampling: The number of sampling units drawn from each stratum is in proportion to the population size of that stratum.

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.

10.9 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 between probability and non probability sampling.

14. What are the guidelines to determine the sample size of a population?

Check Your Progress: Model Answer

1. actually drawn

2. equal

3. replacement

4. judgment sampling

5. successive decisions

10.10 SUGGESTED READINGS

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LESSON

11

DATA COLLECTION

CONTENTS

11.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Distinguish between primary and secondary data
- Understand data collection procedure
- Describe types of syndicated data
- Design questionnaire

11.1 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.

11.2 TYPES OF DATA-SOURCES

11.2.1 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.

11.2.2 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

11.2.3 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.

11.2.4 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.

11.2.5 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. Now-a-days, 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.

11.3 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

1.   ***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.

2.   ***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.

(i) Being an independent agency, there is no bias. The M.R agency is likely to provide an unbiased data.

(ii) The data quality of M.R agency will be good, since they are professionals.

(b) *How was the data collected?*

(i) What instruments was used?

(ii) What type of sampling was done?

(iii) How large was the sample?

(iv) What was the time period of data collection? Example: Days of the week, time of the day.

3.   **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

●   India Today (English) – 4188 thousand

●   Grihshobha v 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

11.4 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

1. **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.

2. *Disguised-Undisguised Observation Methods:* In eisguised 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.

3. *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".

4. *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 of Observation Method

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.

11.5 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.

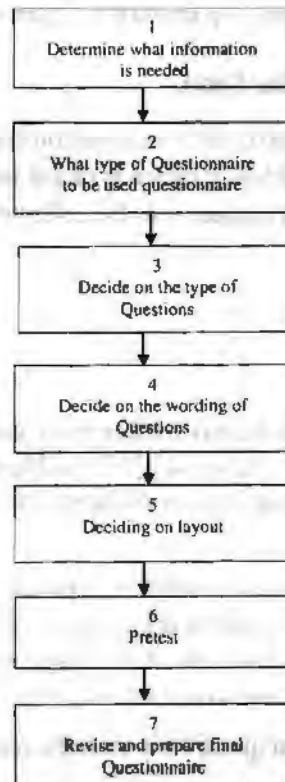   Depending on which answer, respondent chooses, his knowledge on the subject is decided.

   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.

11.6 QESTIONNAIRE DESIGNING

The following are the seven steps:

```
                    ┌──────────────────────┐
                    │          1           │
                    │ Determine what information │
                    │      is needed       │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │          2           │
                    │ What type of Questionnaire │
                    │ to be used questionnaire │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │          3           │
                    │  Decide on the type of │
                    │      Questions       │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │          4           │
                    │ Decide on the wording of │
                    │      Questions       │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │          5           │
                    │   Deciding on layout │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │          6           │
                    │       Pretest        │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │          7           │
                    │ Revise and prepare final │
                    │    Questionnaire     │
                    └──────────────────────┘
```

11.6.1 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.

11.6.2 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.

11.6.3 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.

11.6.4 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. For example, "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. For 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'.

If there is a question, which is not clear or confusing, then the respondent gets more biased rather that getting enlightened. For 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?" For example, "Do you think whether value price equation is attractive"? Here respondents may not know the meaning of value price equation.

11.6.5 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,

1.   Would you like to have a job, if it is possible?

2.   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.

11.6.6 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.

11.6.7 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".

11.6.8 Pre-testing of Questionnaire

Pre-testing of a questionnaire is done to detect any flaws as follows. For example, 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.

11.7 MAIL QUESTIONNAIRE

11.7.1 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

11.7.2 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.

11.8 SAMPLE QUESTIONNAIRES

11.8.1 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

11.8.2 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 ....

11.8.3 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

11.9 ANALYSIS OF DATA

Once all of the participants have completed the study measures and all of the data has been collected, the researcher must prepare the data to be analyzed. Organizing the data correctly can save a lot of time and prevent mistakes.

Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facts and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains.

Data mining is a particular data analysis technique that focuses on modeling and knowledge discovery for predictive rather than purely descriptive purposes. Business intelligence covers data analysis that relies heavily on aggregation, focusing on business information.

In statistical applications, some people divide data analysis into descriptive statistics, exploratory data analysis (EDA), and confirmatory data analysis (CDA). EDA focuses on discovering new features in the data and CDA on confirming or falsifying existing hypotheses. Predictive analytics focuses on application of statistical or structural models for predictive forecasting or classification, while text analytics applies statistical, linguistic, and structural techniques to extract and classify information from textual sources, a species of unstructured data. All are varieties of data analysis.

Data integration is a precursor to data analysis, and data analysis is closely linked to data visualization and data dissemination. The term data analysis is sometimes used as a synonym for data modeling.

11.9.1 The process of data analysis

Data analysis is a process, within which several phases can be distinguished. These phases are defined as under.

1. *Data cleaning:* Data cleaning is an important procedure during which the data are inspected, and erroneous data are—if necessary, preferable, and possible—corrected. Data cleaning can be done during the stage of data entry. If this is done, it is important that no subjective decisions are made. The guiding principle provided is that during subsequent manipulations of the data, information should always be cumulatively retrievable. In other words, it should always be possible to undo any data set alterations. Therefore, it is important not to throw information away at any stage in the data cleaning phase. All information should be saved and all alterations to the data set should be carefully and clearly documented, for instance in a syntax or a log.

2. *Initial data analysis:* The most important distinction between the initial data analysis phase and the main analysis phase is that during initial data analysis one refrains from any analyses that are aimed at answering the original research question. The initial data analysis phase is guided by the following four questions:

    (a) *Quality of data:* The quality of the data should be checked as early as possible. Data quality can be assessed in several ways, using different types of analyses: frequency counts, descriptive statistics (mean, standard deviation, median), normality (skewness, kurtosis, frequency histograms, n: variables are compared with coding schemes of variables external to the data set, and possibly corrected if coding schemes are not comparable.

    (b) *Quality of measurements:* The quality of the measurement instruments should only be checked during the initial data analysis phase when this is not the focus or research question of the study. One should check whether structure of measurement instruments corresponds to structure reported in the literature. There are two ways to assess measurement quality:

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Data Collection

◆ Confirmatory factor analysis

◆ Analysis of homogeneity, which gives an indication of the reliability of a measurement instrument. During this analysis, one inspects the variances of the items and the scales, the Cronbach's á of the scales, and the change in the Cronbach's alpha when an item would be deleted from a scale

(c) *Initial transformations:* After assessing the quality of the data and of the measurements, one might decide to impute missing data, or to perform initial transformations of one or more variables, although this can also be done during the main analysis phase. Possible transformations of variables are:

◆ Square root transformation (if the distribution differs moderately from normal)

◆ Log-transformation (if the distribution differs substantially from normal)

◆ Inverse transformation (if the distribution differs severely from normal)

◆ Make categorical (ordinal / dichotomous) (if the distribution differs severely from normal, and no transformations help)

(d) *Did the implementation of the study fulfill the intentions of the research design:* One should check the success of the randomization procedure, for instance by checking whether background and substantive variables are equally distributed within and across groups. If the study did not need and/or use a randomization procedure, one should check the success of the non-random sampling, for instance by checking whether all subgroups of the population of interest are represented in sample. Other possible data distortions that should be checked are:

◆ dropout

◆ Item nonresponse whether this is random or not should be assessed during the initial data analysis phase

◆ Treatment quality

(e) *Characteristics of data sample:* In any report or article, the structure of the sample must be accurately described. It is especially important to exactly determine the structure of the sample when subgroup analyses will be performed during the main analysis phase. The characteristics of the data sample can be assessed by looking at:

◆ Basic statistics of important variables

◆ Scatter plots

◆ Correlations and associations

◆ Cross-tabulations

(f) *Final stage of the initial data analysis:* During the final stage, the findings of the initial data analysis are documented, and necessary, preferable, and possible corrective actions are taken. Also, the original plan for the main data analyses can and should be specified in more detail and/or rewritten. In order to do this, several decisions about the main data analyses can and should be made:

♦ In the case of non-normal: should one transform variables; make variables categorical, adapt the analysis method?

♦ In the case of missing data: should one neglect or impute the missing data; which imputation technique should be used?

♦ In the case of outliers: should one use robust analysis techniques?

♦ In case items do not fit the scale: should one adapt the measurement instrument by omitting items, or rather ensure comparability with other (uses of the) measurement instrument(s)?

♦ In the case of small subgroups: should one drop the hypothesis about inter-group differences, or use small sample techniques, like exact tests or bootstrapping?

♦ In case the randomization procedure seems to be defective: can and should one calculate propensity scores and include them as covariates in the main analyses?

(g) *Analyses:* Several analyses can be used during the initial data analysis phase:

♦ Univariate statistics(single variable)

♦ Bivariate associations (correlations)

♦ Graphical techniques (scatter plots)

It is important to take the measurement levels of the variables into account for the analyses, as special statistical techniques are available for each level:

♦ Nominal and ordinal variables

♦ Continuous variables

3. **Main data analysis:** In the main analysis phase analyses aimed at answering the research question are performed as well as any other relevant analysis needed to write the first draft of the research report.

(a) *Exploratory and confirmatory approaches:* In the main analysis phase either an exploratory or confirmatory approach can be adopted. Usually the approach is decided before data is collected. In an exploratory analysis no clear hypothesis is stated before analysing the data, and the data is searched for models that describe the data well. In a confirmatory analysis clear hypotheses about the data are tested.

Exploratory data analysis should be interpreted carefully. When testing multiple models at once there is a high chance on finding at least one of them to be significant, but this can be due to a type 1 error. It is important to always adjust the significance level when testing multiple models with, for example, a bonferroni correction. Also, one should not follow up an exploratory analysis with a confirmatory analysis in the same dataset. An exploratory analysis is used to find ideas for a theory, but not to test that theory as well. When a model is found exploratory in a dataset, then following up that analysis with a confirmatory analysis in the same dataset could simply mean that the results of the confirmatory analysis are due to the same type 1 error that resulted in the exploratory model in the first place. The confirmatory analysis therefore will not be more informative than the original exploratory analysis.

(b) *Stability of results:* It is important to obtain some indication about how generalizable the results are. While this is hard to check, one can look at the stability of the results. Are the results reliable and reproducible? There are two main ways of doing this:

- ♦ Cross-validation: By splitting the data in multiple parts we can check if analyzes (like a fitted model) based on one part of the data generalize to another part of the data as well.

- ♦ Sensitivity analysis: A procedure to study the behavior of a system or model when global parameters are (systematically) varied. One way to do this is with bootstrapping.

(c) *Statistical methods:* Many statistical methods have been used for statistical analyses. A very brief list of four of the more popular methods is:

- ♦ General linear model: A widely used model on which various methods are based (e.g. t test, ANOVA, ANCOVA, MANOVA). Usable for assessing the effect of several predictors on one or more continuous dependent variables.

- ♦ Generalized linear model: An extension of the general linear model for discrete dependent variables.

- ♦ Structural equation modelling: Usable for assessing latent structures from measured manifest variables.

- ♦ Item response theory: Models for (mostly) assessing one latent variable from several binary measured variables

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Check Your Progress

Fill in the blanks:

1. .... is also the first hand data collected by the researcher for the immediate purpose of the study.

2. Secondary data are statistics that ....

3. In ...., only present/current behaviour can be studied.

4. A questionnaire is a tool used to ....

5. A leading question is also known as ....

11.10 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 two 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 two 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.

Once all of the participants have completed the study measures and all of the data has been collected, the researcher must prepare the data to be analyzed. Organizing the data correctly can save a lot of time and prevent mistakes. Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facts and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains.

11.11 KEYWORDS

Primary Data: Data directly collected by the researcher, with respect to problem under study, is known as primary data.

Internal Secondary Data: Is that data which is a part of company's record, for which research is already conducted.

Recency: This refers to "How old is the information?" If it is five years old, it may be useless.

Structured disguised Questionnaire: This type of Questionnaire is used to find, peoples' attitude, when a direct undisguised question produces a bias.

11.12 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 and 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?

Check Your Progress: Model Answer

1.   Primary data

2.   already exists

3.   observation method

4.   collect the data

5.   loaded question

11.13 SUGGESTED READINGS

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LESSON

12

PILOT STUDY

12.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

●   Explain the concept of case study

●   Descrone the steps in processing data

●   Analyse data

12.1 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.

12.2 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

12.3 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.

12.3.1 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.

12.3.2 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

For 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 four 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. For 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 two 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

12.3.3 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 two 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.

12.3.4 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 two 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	ɪ̵ɪ̵ɪ̵ɪ̵				5
1,500	ɪ̵ɪ̵ɪ̵ɪ̵	ɪ̵ɪ̵ɪ̵			8
2,000	ɪ̵ɪ̵ɪ̵ɪ̵	ɪ̵ɪ̵ɪ̵ɪ̵	II		12
2,500	ɪ̵ɪ̵ɪ̵ɪ̵	ɪ̵ɪ̵ɪ̵ɪ̵	ɪ̵ɪ̵ɪ̵ɪ̵	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 two 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.

12.3.5 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.

12.3.6 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 three 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.

Fm_d = 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 $M_d = 21568$

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.

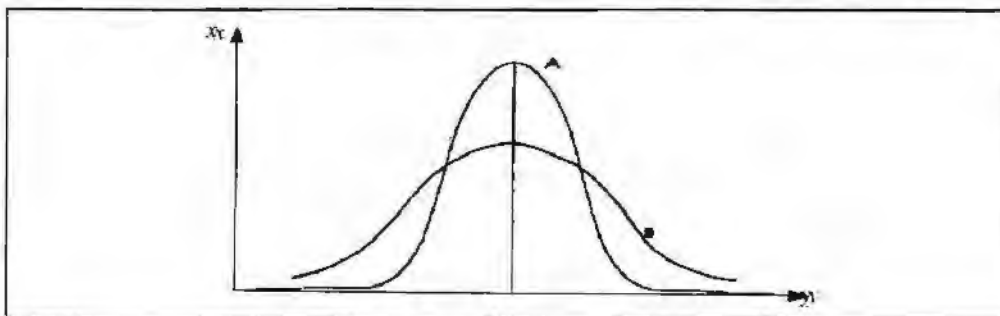$$\text{Eqn.,} \quad X = \Sigma\left(\frac{fx}{\Sigma f}\right)$$

Example: 2 students **X**, **Y** attend 3 classes tests and the scores areas follows:

Though Mean is same, X is better than Y.

12.3.7 Measures of Dispersion

Introduction

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

Dispersion is the spread of the data in a distribution. A measure of dispersion 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.

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. $\dfrac{H - L}{H + L}$ is called the coefficient of range.

Semi-inter quartile range (Quartile deviation) semi-inter quartile range Q.

Q is given by $Q = \dfrac{Q_3 - Q_1}{2}$

Note: 1. $\dfrac{Q_3 - Q_1}{Q_3 + Q_1}$ 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 $(\bar{x}) = \dfrac{\sum f_i \, |x_i - \bar{x}|}{N}$

2. Of all the mean deviations taken about different averages mean derivation about the median is the least.

3. $\dfrac{MD(A)}{A}$ is called the coefficient of mean deviation.

Variance and Standard Deviation

Variance (σ^2): A measure of the average squared distance between the mean and each term in the population.

$$\sigma^2 = \frac{1}{N} \sum f_i (x_i - \bar{x})^2$$

Standard deviation (σ) is the positive square root of the variance

$$\sigma = \sqrt{\frac{1}{N} \sum f_i (x_i - \bar{x})^2}$$

$$\sigma^2 = \frac{1}{N} \sum f_i (x_i^2 - (\bar{x})^2)$$

Note: Combined variance of two sets of data of N_1 and N_2 items with means x_1 and x_2 and standard deviations σ_1 and σ_2 respectively is obtained by

$$\sigma^2 = \frac{N_1 \sigma_1^2 + N_2 \sigma_2^2 + N_1 d_1^2 + N_1 d_2^2}{N_1 + N_2}$$

Where, $d_1^2 = (\bar{x} - \bar{x}_1)^2$, $d_2^2 = (\bar{x} - \bar{x}_2)^2$

and $\bar{x} = \dfrac{N_1 \bar{x}_1 + N_2 \bar{x}_2}{N_1 + N_2}$

Sample variance (σ^2): Let $x_1, x_2, x_3, \dots\dots\dots x_n$, represents a sample with mean $\bar{x}$ Then sample variance σ^2 is given by

$$\sigma^2 = \frac{\sum (x - \bar{x})^2}{n - 1}$$

$$= \frac{\sum x^2}{n - 1} - \frac{n(\bar{x})^2}{n - 1}$$

Note: $\sigma = \sqrt{\dfrac{\sum (x - \bar{x})^2}{n - 1}} = \sqrt{\dfrac{\sum x^2}{n - 1} - \dfrac{n(\bar{x})^2}{n - 1}}$ 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.

$$C.V. = \frac{\sigma}{x} \times 100$$

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,

$$\frac{n+1}{4} = \frac{14}{4} = 3.5$$

$$\frac{3(n+1)}{4} = 10.5$$

$$\therefore Q_1 = 103 + 0.5 (103 - 103) = 103$$

$$Q_3 = 174 + 0.5 (200 - 174) = 187$$

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

Solution:

X	F	Cf	fx	$|x - \bar{x}|$	$|x - M|$	$f|x - \bar{x}|$	$f|x - M|$
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

$$\bar{x} = \frac{\Sigma f_i x_i}{N} = \frac{414}{21} = 19.71$$

$$\frac{N+1}{2} = \frac{22}{2} = 11 \therefore \text{Median } M = 18$$

Now (i) M.D. $(\bar{x}) = \dfrac{\sum f_i |x_i - \bar{x}|}{N} = \dfrac{69.71}{21} = 3.32$

Coefficient of MD $(\bar{x}) = \dfrac{MD(\bar{x})}{\bar{x}} = \dfrac{3.32}{19.71} = 0.16$

(ii) M.D. $(M) = \dfrac{\sum f_i |x_i - M|}{N} = \dfrac{68}{21} = 3.24$

Coefficient of MD $(M) = \dfrac{MD(M)}{M} = \dfrac{3.24}{18} = 0.18$

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:

Class interval	Sample A	Midpoint x	$u = \dfrac{x - 1000}{200}$	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

$$\bar{u}_A = \frac{32}{60} = 0.533$$

$$\bar{x}_A = 1000 + 200$$

$\therefore \qquad \bar{x}_A = 1000 + 200\,(0.533) = 1106.67$

$$\sigma_u^2 = \frac{1}{N} = \Sigma fu^2 - (\bar{u}) = \frac{68}{60} - (0.533)^2$$
$$= 1.133 - 0.2809$$
$$\sigma_u^2 = 0.8524$$
$$\sigma_u = 0.9233$$
$$\sigma_x = 200 \times 0.9233 = 184.66$$

$\therefore$ CV for sample A $= \dfrac{\sigma_A}{\bar{x}_A} \times 100$

$$= \frac{184.66}{1106.67} \times 100 = 16.68\,\%$$

Class interval	Sample B	Midpoint x	$u = \dfrac{x-1000}{200}$	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

$$\overline{V} = \frac{15}{60} = 0.25$$

$$\overline{x}_B = 1000 + 200\,\overline{V}$$
$$= 1000 + 58$$

$$\therefore \quad \overline{x}_B = 1058$$

$$\sigma_v^2 = \frac{1}{N}\Sigma fv^2 - (\overline{V})^2 = \frac{27}{60} - (0.25)^2$$
$$= 0.45 - 0.0625$$
$$\sigma_v^2 = 0.3875$$
$$\sigma_v = 0.6225$$
$$\sigma_B = 200\,\sigma_v$$
$$= 200 \times 0.6225 = 124.5$$

C.V for Sample B $= \dfrac{\sigma_B}{\overline{x}_B} \times 100$

$$\frac{124.5}{1058} \times 100 = 11.77\%$$

Since C.V. for sample B is smaller, sample B lamps are more uniform.

12.4 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 two 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 three 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.

12.4.1 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.

12.4.2 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".

Check Your Progress

Fill in the blanks:

1. A pilot survey is very useful when the actual survey is to be on a ....

2. Coding speeds up the tabulation while editing eliminates ....

3. .... refers to counting the number of cases that fall into various categories.

4. .... lies precisely halfway between highest and lowest values.

5. Coefficient of variation (C.V.) is a relative measure of dispersion that enables us to compare ....

12.5 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.

12.6 KEYWORDS

Editing: Editing, include inspection and correction of each questionnaire.

Frequency Distribution: Frequency distribution, organizes data into classes or groups.

Mode: The mode is the central value or item that occurs most often, when data is categorized in a frequency distribution.

Median: Median lies precisely halfway between highest and lowest values.

12.7 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. 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

Check Your Progress: Model Answer

1. big scale

2. errors

3. Tabulation

4. Median

5. two distributions

12.8 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

TEST OF SIGNIFICANCE

13.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Know assumptions, advantages and disadvantages of parametric and non-parametric test

- Describe T-test and F-test

- Analyse ANOVA

- Understand SPSS and its applications

13.1 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.

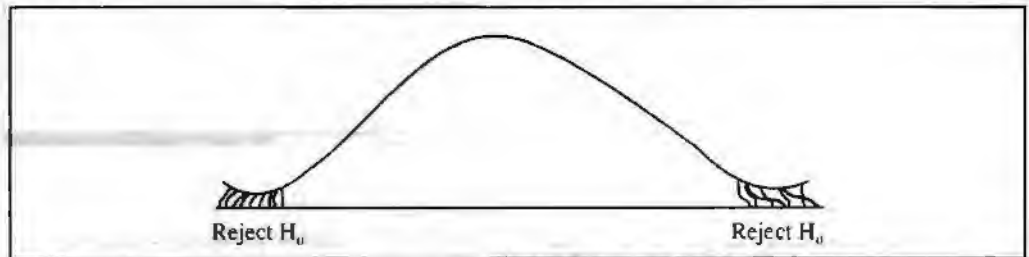One-tailed and two-tailed tests

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.

Reject H_0
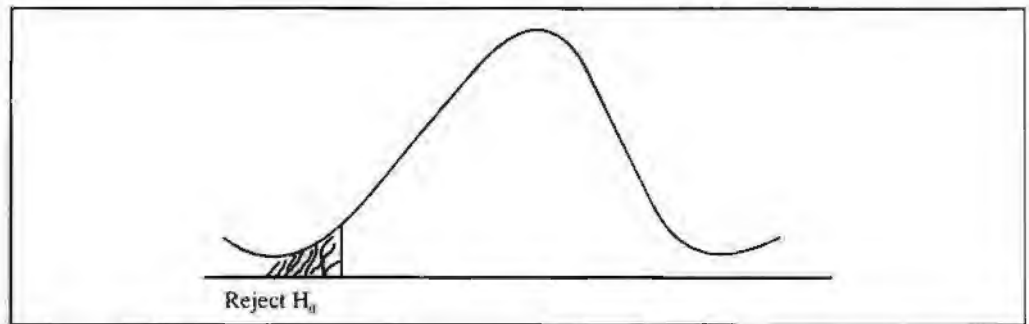
Example 1: In a right side test, the critical region lies entirely in the right tail of the sample distribution. Whether the test is one-sided or two-sided – depends on alternate hypothesis.

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.

Reject H_0 Reject H_0

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

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.

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.

13.2 ASSUMPTIONS ABOUT PARAMETRIC AND NON-PARAMETRIC TEST

1. Observations in the population are normally distributed.
2. Observations in the population are independent to each other.
3. Population should posses' homogeneous characteristics.
4. Samples should be drawn using simple random sampling techniques.
5. To use T test sample size should be less than 30.
6. To use F test sample size should be less than 30.
7. To use Z test sample size should be more than 30.
8. To use chi square minimum number of observation should be five.

13.2.1 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.

13.2.2 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.

13.3 PARAMETRIC TESTS

13.3.1 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.

13.3.2 Null Hypothesis

There is no significant difference between Nourishment programme 'A' and 'B'.

13.3.3 Alternative Hypothesis

Nourishment programme B is better than 'A' or Nourishment programme 'B' increase the children's weight significantly.

Illustration 1: 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.

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 $n_1 = 5$ $n_1 = 7$

$\Sigma x = 230$ $\Sigma y = 399$

$\Sigma(x - x)^2 = 310$ $\Sigma(y - \bar{y})^2 = 674$

$$\bar{x} = \frac{\Sigma x}{n_1} = \frac{230}{5} = 46$$

$$\bar{y} = \frac{\Sigma y}{n_2} = \frac{399}{7} = 57$$

$$s^2 = \frac{1}{n_1 + n_2 - 2} \left\{ \Sigma \left(x - \bar{x} \right)^2 + \Sigma \left(y - \bar{y} \right)^2 \right\}$$

$$D.F = (n_1 + n_2 - 2) = (5 + 7 - 2) = 10$$

$$s^2 = \frac{1}{10} \{ 310 + 674 \} = 98.4$$

$$t = \frac{46 - 57}{\sqrt{98.4 \times \left(\frac{1}{5} + \frac{1}{7} \right)}}$$

$$= \frac{-11}{\sqrt{98.4 \times \left(\frac{12}{35} \right)}}$$

$$= \frac{-11}{\sqrt{33.73}} = -\frac{11}{5.8}$$

$$= -1.89$$

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.

13.4 F TEST

13.4.1 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.

13.4.2 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

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Test of Significance

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?

13.4.3 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 2: 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. $\bar{\bar{x}}$

3. Calculate variance between columns using the formula $\bar{\sigma}^2 = \dfrac{\sum n_i \left(x_i - \bar{\bar{x}}\right)^2}{k-1}$ where $K = (n_1 + n_2 + n_3 - 3)$.

4. Calculate sample variance. It is calculated using formula:

    Sample variance $s_i^2 = \dfrac{\sum \left(x_i - \bar{x}\right)^2}{n-1}$ where n is No. of observation under each method.

5. Calculate variance within columns using the formula $\bar{\sigma}^2 = \dfrac{\sum n_i - 1}{n_r - k}$

6. Calculate F using the ratio $F = \left(\dfrac{\text{between column variance}}{\text{within column variance}}\right)$

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. $= \Sigma(n_i - k)$

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:

    $$\bar{x}_1 = \frac{85}{5} = 17, \ \bar{x}_2 = \frac{105}{5} = 21, \ \bar{x}_3 = \frac{114}{6} = 19$$

2. Grand mean

$$\overline{\overline{x}} = \frac{15+18+19+22+11+22+27+18+21+17+24+19+16+22+15+18}{16}$$

$$= \frac{304}{16} = 19$$

3. Calculate variance between columns:

N	$\overline{x}$	$\overline{\overline{x}}$	$\overline{x} - \overline{\overline{x}}$	$\left(\overline{x} - \overline{\overline{x}}\right)^2$	$n\left(\overline{x} - \overline{\overline{x}}\right)^2$
5	17	19	–2	4	$5 \times 4 = 20$
5	21	19	2	4	$5 \times 4 = 20$
6	19	19	0	0	$6 \times 0 = 0$
				$\Sigma n_i \left(\overline{x_i} - \overline{\overline{x}}\right)^2$	$= 40$

$$\overline{\sigma}^2 = \frac{\Sigma n_i \left(x_i - \overline{\overline{x}}\right)^2}{k-1} = \frac{40}{3-1} = 20$$

Variance between column = 20

Training method - 1		Training method - 2		Training method -3	
$x - \overline{x}$	$\left(x - \overline{x}\right)^2$	$x - \overline{x}$	$\left(x - \overline{x}\right)^2$	$x - \overline{x}$	
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	$(-4)^2 = 16$
$\Sigma\left(x - \overline{x}\right)^2 = 70$		$\Sigma\left(x - \overline{x}\right)^2 = 62$		$\Sigma\left(x - \overline{x}\right)^2 = 60$	

4. Sample variance $= \dfrac{\Sigma\left(x - \overline{x}\right)^2}{n-1} = \dfrac{70}{5-1}, \dfrac{\Sigma\left(x - \overline{x}\right)^2}{n-1} = \dfrac{62}{5-1}, \dfrac{\Sigma\left(x - \overline{x}\right)^2}{n-1} = \dfrac{60}{6-1}$

$$s_1^2 = \frac{70}{4} = 17.5, \ s_2^2 = \frac{62}{4} = 15.5, \ s_3^2 = \frac{60}{5} = 12$$

5. Within column variance $\overline{\sigma}^2 = \Sigma\left(\dfrac{n_i - 1}{n_i - k}\right)s_i^2$

$$\left(\frac{5-1}{16-3}\right) \times 17.5 + \left(\frac{5-1}{16-3}\right) \times 15.5 + \left(\frac{6-1}{16-3}\right) \times 12$$

$$= \left(\frac{4}{13}\right) \times 17.5 + \left(\frac{4}{13}\right) \times 15.5 + \frac{5}{13} \times 12$$

Within column variance $= \dfrac{192}{13} = 14.76$

6. $F = \dfrac{\text{Between column variance}}{\text{Within column variance}} = \dfrac{20}{14.76} = 1.354$

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 H_0, the null hypothesis.

Conclusion: There is no significant difference in the effect of the three training methods.

13.5 CHI-SQUARE TEST

A chi-squared test, also referred to as chi-square test or $\div^2$ test, is any statistical hypothesis test in which the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true, or any in which this is asymptotically true, meaning that the sampling distribution can be made to approximate a chi-squared distribution as closely as desired by making the sample size large enough.

Some examples of chi-squared tests where the chi-squared distribution is only approximately valid:

* Pearson's chi-squared test, also known as the chi-squared goodness-of-fit test or chi-squared test for independence. When the chi-squared test is mentioned without any modifiers or without other precluding context, this test is usually meant (for an exact test used in place of $\div^2$, see Fisher's exact test)

* Yates's correction for continuity, also known as Yates' chi-squared test.

* Cochran–Mantel–Haenszel chi-squared test.

* McNemar's test, used in certain 2 × 2 tables with pairing

* Tukey's test of additivity

* The portmanteau test in time-series analysis, testing for the presence of autocorrelation

* Likelihood-ratio tests in general statistical modeling, for testing whether there is evidence of the need to move from a simple model to a more complicated one (where the simple model is nested within the complicated one).

One case where the distribution of the test statistic is an exact chi-squared distribution is the test that the variance of a normally distributed population has a given value based on a sample variance. Such a test is uncommon in practice because values of variances to test against are seldom known exactly.

Therefore generally speaking, the chi-square test is a statistical test used to examine differences with categorical variables. There are a number of features of the social world we characterize through categorical variables - religion, political preference, etc. To examine hypotheses using such variables, use the chi-square test.

The chi-square test is used in two similar but distinct circumstances:

* for estimating how closely an observed distribution matches an expected distribution - we'll refer to this as the goodness-of-fit test

* for estimating whether two random variables are independent.

13.5.1 The Goodness-of-Fit Test

One of the more interesting goodness-of-fit applications of the chi-square test is to examine issues of fairness and cheating in games of chance, such as cards, dice, and roulette. Since such games usually involve wagering, there is significant incentive for people to try to rig the games and allegations of missing cards, "loaded" dice, and "sticky" roulette wheels are all too common.

So how can the goodness-of-fit test be used to examine cheating in gambling? It is easier to describe the process through an example. Take the example of dice. Most dice used in wagering have six sides, with each side having a value of one, two, three, four, five, or six. If the die being used is fair, then the chance of any particular number coming up is the same: 1 in 6. However, if the die is loaded, then certain numbers will have a greater likelihood of appearing, while others will have a lower likelihood.

One night at the Tunisian Nights Casino, renowned gambler Jeremy Turner is having a fantastic night at the craps table. In two hours of playing, he's racked up $30,000 in winnings and is showing no sign of stopping. Crowds are gathering around him to watch his streak - and The Missouri Master is telling anyone within earshot that his good luck is due to the fact that he's using the casino's lucky pair of "bruiser dice," so named because one is black and the other blue.

Unbeknownst to Turner, however, a casino statistician has been quietly watching his rolls and marking down the values of each roll, noting the values of the black and blue dice separately. After 60 rolls, the statistician has become convinced that the blue die is loaded.

Value on Blue Die	Observed Frequency	Expected Frequency
1	16	10
2	5	10
3	9	10
4	7	10
5	6	10
6	17	10
Total	60	60

At first glance, this table would appear to be strong evidence that the blue die was, indeed, loaded. There are more 1's and 6's than expected, and fewer than the other numbers. However, it's possible that such differences occurred by chance. The chi-square statistic can be used to estimate the likelihood that the values observed on the blue die occurred by chance.

The key idea of the chi-square test is a comparison of observed and expected values. How many of something was expected and how many were observed in some process? In this case, we would expect 10 of each number to have appeared and we observed those values in the left column. With these sets of figures, we calculate the chi-square statistic as follows:

$$\chi^2 = \sum \frac{(\text{observed} \times \text{Frequency} - \text{Expected} \times \text{Frequency})^2}{(\text{Expected} \times \text{Frequency})}$$

Using this formula with the values in the table above gives us a value of 13.6.

Lastly, to determine the significance level we need to know the "degrees of freedom." In the case of the chi-square goodness-of-fit test, the number of degrees of freedom is

equal to the number of terms used in calculating chi-square minus one. There were six terms in the chi-square for this problem - therefore, the number of degrees of freedom is five.

We then compare the value calculated in the formula above to a standard set of tables. The value returned from the table is 1.8%. We interpret this as meaning that if the die was fair (or not loaded), then the chance of getting a $\div 2$ statistic as large as or larger than the one calculated above is only 1.8%. In other words, there's only a very slim chance that these rolls came from a fair die. The Missouri Master is in serious trouble.

13.5.2 Testing Independence

The other primary use of the chi-square test is to examine whether two variables are independent or not. What does it mean to be independent, in this sense? It means that the two factors are not related. Typically in social science research, we're interested in finding factors that are related - education and income, occupation and prestige, age and voting behavior. In this case, the chi-square can be used to assess whether two variables are independent or not.

More generally, we say that variable Y is "not correlated with" or "independent of" the variable X if more of one is not associated with more of another. If two categorical variables are correlated their values tend to move together, either in the same direction or in the opposite.

Example

Return to the example discussed at the introduction to chi-square, in which we want to know whether boys or girls get into trouble more often in school. Below is the table documenting the percentage of boys and girls who got into trouble in school?

Participants	Got in Trouble	No Trouble	Total
Boys	46	71	117
Girls	37	83	120
Total	83	154	23

To examine statistically whether boys got in trouble in school more often, we need to frame the question in terms of hypotheses.

1. *Establish Hypotheses:* As in the goodness-of-fit chi-square test, the first step of the chi-square test for independence is to establish hypotheses. The null hypothesis is that the two variables are independent - or, in this particular case that the likelihood of getting in trouble is the same for boys and girls. The alternative hypothesis to be tested is that the likelihood of getting in trouble is not the same for boys and girls.

    However you need to note here that that the chi-square test only tests whether two variables are independent. It cannot address questions of which is greater or less. Using the chi-square test, we cannot evaluate directly the hypothesis that boys get in trouble more than girls; rather, the test can only test whether the two variables are independent or not.

2. *Calculate the expected value for each cell of the table:* As with the goodness-of-fit example described earlier, the key idea of the chi-square test for independence is a comparison of observed and expected values. How many of something was expected and how many were observed in some process? In the case of tabular data, however, we usually do not know what the distribution should look like (as we did with rolls of dice). Rather, in this use of the chi-square test, expected values are calculated based on the row and column totals from the table.

The expected value for each cell of the table can be calculated using the following formula:

$$\frac{\text{Row total} \times \text{Column total}}{\text{Total } \eta \text{ for table}}$$

For example, in the table comparing the percentage of boys and girls in trouble, the expected count for the number of boys who got in trouble is:

$$\frac{(\text{Total number of boys} \times \text{Total number of students who got in trouble})}{(\text{Total } \eta \text{ for table })}$$

The first step, then, in calculating the chi-square statistic in a test for independence is generating the expected value for each cell of the table. Presented in the table below are the expected values (in parentheses and italics) for each cell:

Participants	Got in Trouble	No Trouble	Total
Boys	46 (40.97)	71 (76.02)	117
Girls	37 (42.03)	83 (77.97)	120
Total	83	154	237

3. *Calculate Chi-square statistic:* With these sets of figures, we calculate the chi-square statistic as follows:

$$\text{Chi-square} = \text{Sum of } \frac{(\text{Observed} \times \text{frequency} - \text{expected} \times \text{frequency})^2}{(\text{expected} \times \text{frequency})}$$

In the example above, we get a chi-square statistic equal to:

$$\chi^2 = \frac{(46-40.97)^2}{40.97} + \frac{(37-42.03)^2}{42.03} + \frac{(71-76.03)^2}{76.03} + \frac{(83-77.97)^2}{77.97}$$
$$\chi^2 = 1.87$$

4. *Assess significance level:* Lastly, to determine the significance level we need to know the "degrees of freedom." In the case of the chi-square test of independence, the number of degrees of freedom is equal to the number of columns in the table minus one multiplied by the number of rows in the table minus one.

In this table, there were two rows and two columns. Therefore, the number of degrees of Freedom is:

$$\chi^2 = \frac{(46-40.97)^2}{40.97} + \frac{(37-42.03)^2}{42.03} + \frac{(71-76.03)^2}{76.03} + \frac{(83-77.97)^2}{77.97}$$
$$\chi^2 = 1.87$$

We then compare the value calculated in the formula above to a standard set of tables. The value returned from the table is $p < 20\%$. Thus, we cannot reject the null hypothesis and conclude that boys are not significantly more likely to get in trouble in school than girls.

13.6 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 $H_0 : P_1 = P_2$.

Illustration 3: 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.

Check Your Progress

Fill in the blanks:

1. A hypothesis test may be one-tailed or ....

2. A significance level of say 5% means that the risk of making a ....
   is 5%.

3. To use .... sample size should be less than 30.

4. To use .... sample size should be more than 30.

5. To use .... minimum number of observation should be five.

6. .... tests are used to test the hypothesis with nominal and ordinal data.

13.7 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 two 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.

The chi-square test is a statistical test used to examine differences with categorical variables. There are a number of features of the social world we characterize through categorical variables - religion, political preference, etc. One of the more interesting goodness-of-fit applications of the chi-square test is to examine issues of fairness and cheating in games of chance, such as cards, dice, and roulette. Since such games usually involve wagering, there is significant incentive for people to try to rig the games and allegations of missing cards, "loaded" dice, and "sticky" roulette wheels are all too common.

To recap the steps used in calculating a goodness-of-fit test with chi-square are: Establish hypotheses, Calculate chi-square statistic, and assess significance level. Doing so requires knowing the number of degrees of freedom and finally, decides whether to accept or reject the null hypothesis.

13.8 KEYWORDS

ANOVA: It is a statistical technique. It is used to test the equality of three or more sample means.

Z test (Parametric Test): When sample size is > 30.

Non-parametric Test: Non-parametric tests are used to test the hypothesis with nominal and ordinal data.

13.9 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 between 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?

Check Your Progress: Model Answer

1. two-tailed

2. wrong decision

3. T-test

4. Z-test

5. chi square

6. Non-parametric

13.10 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
14

INTERPRETATION

CONTENTS

14.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

● Define interpretation

● Describe induction and deduction methods of data interpretation

● Interpret regression equation

14.1 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.

14.2 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.

14.3 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".

14.4 INTERPRETATION OF REGRESSION EQUATION

The multiple linear regression equation is given by

$$y = a + b_1 x_1 + b_2 x_2$$

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.

Check Your Progress

Fill in the blanks:

1. Interpretation refers to the task of drawing inferences from the ....

2. There are two methods of drawing conclusions (1) induction (2) ....

3. Deductive reasoning starts from some .... and is then applied to a particular instance.

4. Both logic and .... are essential for interpretation.

14.5 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.

14.6 KEYWORDS

Interpretation: Interpretation means bringing out the meaning of data.

Induction Method: Under this method one starts from observed data and then generalisation is done which explains the relationship between objects observed.

Deduction Method: Under 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.

14.7 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.

Check Your Progress: Model Answer

1. collected data

2. deduction

3. general law

4. observation

14.8 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
15

REPORT WRITING

15.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

●   Know the requirement of report writing

●   Understand the format of written report

●   Describe various types of report writing

●   Use tables, charts and diagrams in report writing

15.1 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.

15.2 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.

15.3 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

    (a) Objectives

    (b) Results

    (c) Conclusions

    (d) Recommendations

4. Body

    (a) Introduction

    (b) Methodology

    (c) Results

    (d) Limitations

5. Conclusions and Recommendations

6. Appendix

    (a) Sampling plan

    (b) Data collection forms

    (c) 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	16-25
	b) Exhibits	26-40
	c) Bibliography	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,

    (a) Objectives of the research report

    (b) Scope of the study

    (c) Limitations

    (d) Key results

    (e) Conclusions

    (f) Recommendations

4. **The Body:** This section includes:

    (a) Introduction

    (b) Methodology

    (c) Results

    (d) Limitations

    (a) *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.

    (b) *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?

    (c) *Results:* What was the final result of the study?

    (d) *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:*

    (a)   What was the conclusion drawn from the study?

    (b)   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.

15.4 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	
5.	Summary of findings and suggestions	
	Bibliography	
6.	Appendix	

15.5 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

15.5.1 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.

15.5.2 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.

15.5.3 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.

15.5.4 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.

15.5.5 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.

15.5.6 Informal Report

The report prepared by the supervisor by way of filling the shift log book, to be used by his colleagues.

15.5.7 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.

15.6 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

15.7 MECHANICS OF WRITING REPORTS

1. Size and physical design

2. Procedure

3. Layout

4. Treatment of quotations

5. Foot notes

6. Documentation style

7. Punctuation and abbreviations in foot notes

15.8 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.

15.9 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.

15.10 GRAPHS

1. 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.

2. 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.

3. 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.

4. Proportional changes in the values of the variables can be shown by drawing a ratio or logarithmic scale.

5. A graph must not be overcrowded with curves.

6. An index should always be given to show the scales and the interpretation of different curves.

7. The source of data should be mentioned as a footnote.

15.11 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

- Krishna Murthy, P., *"Towards Excellence in Management"* (Paper presented at a Seminar in XYZ College Bangalore, July 2000).

Check Your Progress

Fill in the blanks:

1. Long report could be both a technical report as well as ....

2. .... prepared by the supervisor by way of filling the shift log book, to be used by his colleagues.

3. The table should be simple and .... which is not overloaded with details.

4. Every graph must have a suitable title written at its ....

5. .... contain questionnaires and other relevant material of the study.

6. The .... contains the source of every reference used and any other relevant work that has been consulted.

15.12 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.

15.13 KEYWORDS

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.

Appendix: The purpose of an appendix is to provide a place for material which is not absolutely essential to the body of the report.

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.

Title Page: Title Page should indicate the topic on which the report is prepared.

15.14 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

Check Your Progress: Model Answer

1. non-technical report

2. Informal report

3. compact

4. top

5. Appendices

6. bibliography

15.15 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

ORAL PRESENTATION

16.0 AIMS AND OBJECTIVES

After studying this lesson, you should be able to:

- Know the broad classification of an oral presentation
- Know the guidelines for preparing oral report
- Understand the requirement of oral presentation of research report

16.1 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.

16.2 NATURE OF AN ORAL PRESENTATION

16.2.1 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.

16.2.2 Finding/Conclusion

Each conclusion may be stated backed up by findings.

16.2.3 Recommendation

Each recommendation must have the support of conclusion. At the end of the presentation, question-answer session should follow from the audience.

### 16.2.4 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.

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.

16.3 GUIDELINES
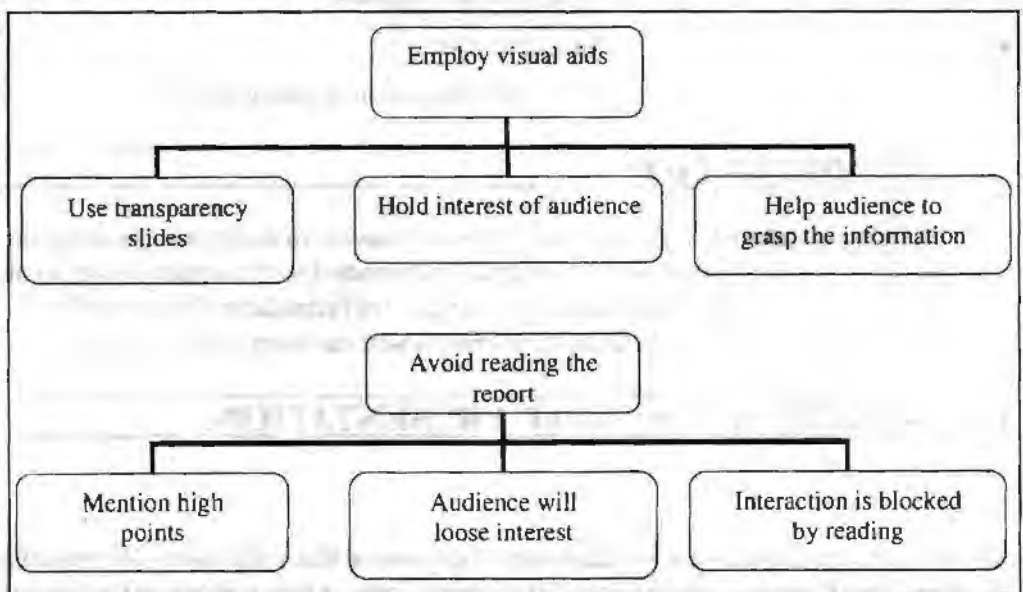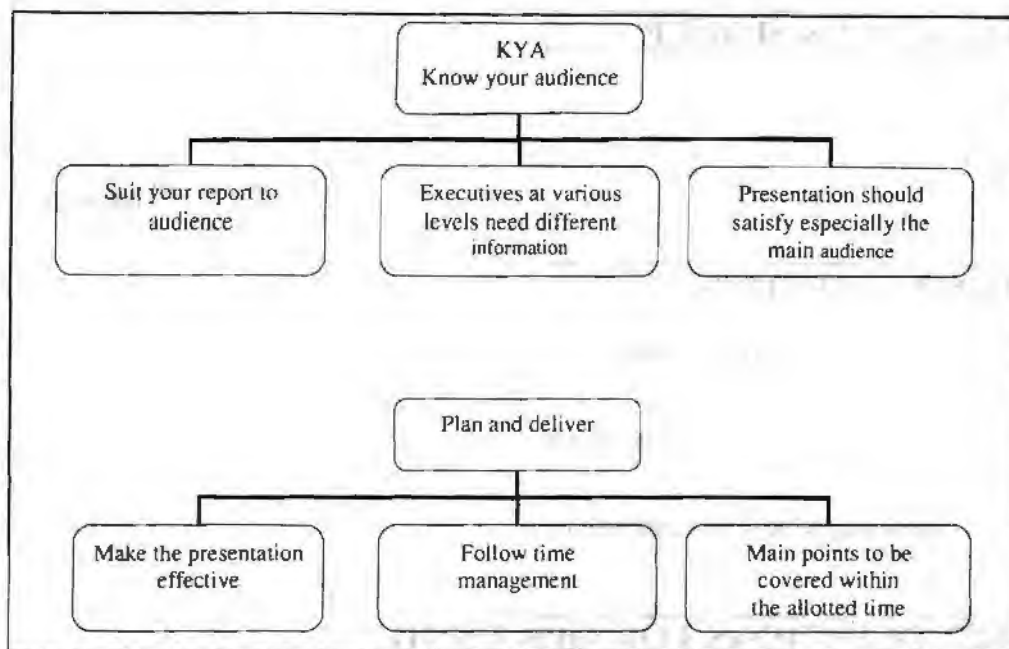
16.4 CHECKLIST FOR ORAL PRESENTATION

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.

Check Your Progress

Fill in the blanks:

1. In an oral presentation, ... plays a big role.

2. In opening statement brief statement can be made on the .... that will follow.

3. In oral report the presenter should know his ....

4. Language used in oral presentation must be ....

16.5 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.

16.6 KEYWORDS

Opening Statement: The opening statement should explain the nature of the project, how it came about and what was attempted.

Oral Report: The oral report is the type of report which is presented orally by the reporter.

Recommendation: Recommendation means something that recommends (or expresses commendation) of a person or thing as worthy or desirable.

16.7 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.

Check Your Progress: Model Answer

1.   communication

2.   nature of discussion

3.   target audience

4.   simple and understandable

16.8 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.