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BUSINESS RESEARCH METHODS

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Prepared by

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SYLLABUS

Core Course: BBA5 B08 BUSINESS RESEARCH METHODS

Lecture Hours per week: 4   Credits: 4   Internal: 20, External: 80

Objectives :> To enable students for acquiring basic knowledge in business research methods and to develop basic skills in them to conduct survey researches and case studies.

Module I   Business Research: – Definition and significance - Features of business research – The research process – Variable - Proposition - Types of research – Exploratory and causal research – Theoretical and empirical research - Basic and applied research - Descriptive research – Phases of business research – Research Hypothesis – Characteristics – Research in an evolutionary perspective – Role of theory in research - Theory building - Induction and Deduction Theory.   (10 Hours)

Module II   Research Design – Definition – Types of research design – Exploratory and causal research design -Descriptive and experimental design – Types of experimental design – Validity of findings –Internal and external validity – Variables in research – Measurement and scaling – Different scales –Construction of instrument - Validity and reliability of instrument -   (15 Hours)

Module III   Data Collection: - Types of data – Primary Vs secondary data – Methods of primary data collection –Survey Vs observation – Experiments – Construction of questionnaire and instrument – Validation of questionnaire – Sampling plan – Sample size – Sampling methods - Determinants of optimal sample size – Sampling techniques – Probability Vs non probability sampling methods.   (15 Hours)

Module IV   Data Processing: Processing stages - Editing - Coding and data entry – Validity of data –Qualitative Vs quantitative data analysis – Frequency table - Contingency table - Graphs - Measures of central tendency and index number – Testing of Hypothesis - Bivariate and multivariate statistical techniques – Factor analysis – Discriminant analysis- Cluster analysis –Interpretation.   (15 Hours)

Module V   Research Report: Different types – Contents of report – Need of executive summary –Chapterisation – Contents of chapter - Report writing stages – The role of audience – Readability –Comprehension – Tone – Final proof – Report format – Title of the report – Ethics in research –Subjectivity and objectivity in research   (15 Hours)

Reference Books:

1. Donald Cooper and Pamela S, Schindler: Business Research Methods. Latest Edition, Irwin McGraw- Hill International Editions, New Delhi.

2. John Adams, Hafiz T.A. Khan Robert Raeside, David White: Research Methods for Graduate Business and Social Science Students, Response Books. New Delhi.

3. Kothari C. R., Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi.

4. Neresh K. Malhotra: Marketing Research, Latest Edition. Pearson Education.

5. William G. Zikmund, Business Research Methods, Thomson.

6. Wilkinson T.S. and Bhandarkar P.L, Methodology and Techniques of Social Research, Himalaya Publishers.

7. John W. Best And James V. Khan, Research in Education.

INTRODUCTION TO RESEARCH AND BUSINESS RESEARCH

Research

● Meaning of research: - "Intensive or in depth search for knowledge"

(Knowledge is - know what (facts), know why (scientific principle), know who (users of knowledge), know how (skills or capability))

● Definition of Research: - "A careful investigation or inquiry specially through search for new facts in any branch of knowledge" (Advanced learners Dictionary)

Business Research

● Meaning of Business Research: - "systematic study of the problems encountered by business organizations with a view to finding to the solutions to the problem in the interest of stake holders"

● Definition of Business Research:- " it is the planning, collection and analysis of data relevant to business decision making and communication of the result of this analysis to the management" (MC Daniel and Gates)

Need & Significance *of Business Research*

● To increase quality of managerial decision by logical and scientific decisions.

● To enable the manager to make the right choice.

● To make predictive judgments about a new project, project feasibility and project implementation.

● To help the management in discharging its functions- planning, coordinating, motivating, controlling and evaluation effectively.

● To provide accurate information about business environment in which business operates locating threats and opportunities.

● To make innovations through R& D (Research and Development) activities of an organization.

● To frame alternative area of purchase policies- where/when/how much/what price to buy.

● To help in financial management optimizing capital mix, cash management, cost control, pricing.

● To help in human resource area- personnel policies, job design, job analysis etc.

Features *of Business Research*

Business research is:

● Step/process/stages oriented - collection, analysis and interpretation of data.

● Objective oriented

● Interdisciplinary- research involves use of tools of different social sciences like psychology, economics, sociology, mathematics etc.

- Extensive use of internet

- Demand driven

- Flexible

- Empowerment of managers.

- Use of both primary and secondary data.

- Customer oriented –research focuses more on customer and his influence.

- Time bound

- Systematic – Pre designed steps are adopted for research.

- Dynamic - approach of rapid changes.

Types of Business Research

(1) **Basic research** - also called *pure research, fundamental research* –it is concerned with generalization and the formulation of theory/theory based/expansion of knowledge/designing and constructing new theories instead of irrelevant old ones/ it may not have immediate commercial value/foundation for applied research/
 Example: - e= mc2

(2) **Applied research –** also called *practical research, action research*-it is the finding solution to the current problem/need based/high practical relevance/ integrates previous theories/contribute new theories
 Example:- application of e= mc2 in energy formation.

(3) **Exploratory research**- it is the initial work any investigation by discovering new facts, things, ideas , and getting insight into unexplored area of a particular topic./carried out before formulating hypothesis.
 Example: - some initial research or inquiry is conducted by a company before setting up its new outlet in other area.

(4) **Descriptive research-** it is a fact finding investigation. Carried out with the objective of describing particular situation, event, or an individual. it answers to what, when, who, how, where etc. so,
 Example: - *survey research* or comparative *research* or *ex-post facto research.*
- *Survey is the process of gathering information from the respondents on the basis of questionnaire or personal interview.*
- *If a research is undertaken about events that have already taken place it is called ex post facto research.*

(5) **Causal research:-** it is to answer *WHY* questions. This research aims at identifying cause and effect relationship between variables. It determines whether one or more variables causes or affects one or more outcomes.
 Example:- study of effectiveness of advertisement on increase of volume of sales.

(6) Analytical research: - It is the use of facts and information already available and analyses them in depth to make critical examination through various angles of the material or the object. Statistical techniques like correlation, multivariate analysis, testing of hypothesis etc. are used for this purpose.
Example: - post mortem studies and ex post facto studies.

(7) Theoretical research:- it is for formulating theories which help in understanding different subject an answering / solving the current problems.
Example: - Demand theory, Supply theory-which helps to understand and answer to the market conditions.

(8) Empirical research: - *Empirical* means *experience.* It is conducted on the basis of experience or observations of researcher. It is *not based on any theory or system.* This research *is also called experimental research.* Its validity can be checked through reliable sources and evidences.
Example: - work place practices, recruitment mechanism, and technology diffusion (improvement or development)

(9) Quantitative research: - it is based on measurement of the phenomenon or objects under the study.
Example: - censes survey studies.

(10) Qualitative research: - it is the subjective assessment of the attributes, motives, opinions, desires, preferences, behaviour etc.
Example: - study of employees behaviour at work place.

STEPS/STAGES/PROCESS/PHASES OF BUSINESS RESEARCH

Business research is systematic inquiry which consists of 10 important steps given below:

1. **Choice of research area**
   - Researcher must discover exact problem area which demands solution to conduct his research on it, considering all factors influencing the selection of problem.
2. **Review of related literature (RRL)**
   - Refer all available sources of information and wide literatures relating to the selected problem.
3. **Formulation of research question(Problem definition)**
   - The recognition or existence of a problem motivates research. Unless there is a problem to be solved, the investigation cannot proceed. So, the PROBLEM sets the goal or direction of research. **Example**: - world economic depression due to COVID'19 is a research problem which demands an inquiry to recover and solve the crisis.
4. **Formulation of hypothesis.**
   - A hypothesis is specific statement of prediction for an observable phenomenon and it is formulated for empirical testing. ***Hypothesis is a tentative solution /explanation//a guess/assumption /statement to the problem facing the researcher***. Hypothesis may or may not real solution or finding to the problem.
     Example: - students from IIMs are placed faster than other B schools.
5. **Developing research design**
   - Research design is also known as *Research outline*, *Research plan*, and *Research blue print*. It is the plan, structure and strategy of the investigation designed to obtain answers

to research questions. The research design contains everything the investigator will do from the beginning to the end of the research work.

Research design should contain information about

(a) *The sampling design* – sampling unit, size of the sample, method of sampling.
(b) *Data collection design-* questionnaire, interview, observation.
(c) *Instrument design-* type of data, communication approach, question structure, question wording.

After making the instrument, subject it to *pilot testing* which detects the weakness in the design and content of the instrument.

6. **Collection of data –**
   After designing blue print, data are collected on the basis of this design by using different data collection methods.

7. **Data processing and analysis.**
   - Data processing is done with *editing*, *coding, classifying and tabulating* the data.
   - Analysis of tabulated data is done using statistical techniques like *averages* (mean, median, and mode), *percentages, trend analysis, correlation and regression* techniques.
   -Testing of hypothesis is done in this stage.

8. **Interpretation of data.**
   - It is done with the intention of seeking explanation for the research result on the basis of existing theories.

9. **Formulating conclusions and preparing the report.**
   - Prepare here research report for presenting before interested parties
   - Essentially it should have the following contents
   - -the *preliminary section*
   - - a *main text section*
   - - the *end section*

10. **Replicate or copy the study for generalizations.**
    Generalization is made to build a new theory. Such generalization comes up with better explanation and new theories for existing phenomenon.

RESEARCH IN EVOLUTI0NARY PERSPECTIVE

● The term Evolution means *Unfolding.* It narrates how things changes. The research roles for these changes.

● Research outcome /knowledge is acquired through four ways –

   1. Direct understanding (observation)

   2. Though sounds

   3. Hypothetical understanding (assumptions)

   4. Historical understanding.

All of these open versatile horizons of research explorations.

ROLE OF *THEORY* IN RESEARCH

THEORY

Theory is derived from Greek word 'theoria' which means contemplation or speculation. Theory can be portrayed as abstract ideas about something or phenomenon.

- It is an explanation of observed regularity which satisfies the logic of performance.

Research and theory dependent each other-"**any curiosity**" leads to enquiry of "**cause and effect relationship**" which leads to **"theory".** It stands for the test of research.

THEORY BUILDING

- Any statement cannot be accepted without empirical or logical verification.
- After the analysis of the data (empirical verification), we have to draw broad conclusions and generalizations. This process is known as **theory building**. It is **inductive** in nature.
- Theory building requires on going comparison between theory and data and the continuous modification between theory and practice.

## INDUCTIVE APPROACH   and   DEDUCTIVE APPROACH

INDUCTIVE APPROACH
- It is the process of reasoning whereby we arrive from PARTICULAR facts at GENERALISATION
- I.e.; from particular observations or instances to a general rule or principle/theory.

Observation	Pattern	Hypothesis	Theory

- **Example: -** It is observed that "a number of cases that when price increases, less is purchased", so we reach in a conclusion or generalization of DEMAND THEORY that "when Price increases Demand decreases".
- **Another example: -** all managers that have ever been seen are human beings;
- Therefore, all managers are human beings

DEDUCTIVE APPROACH

- It is the process of reasoning whereby we arrive from GENERALISATION at PARTICULAR facts.
- I.e.; from a general rule or principle/theory to particular observations or instances

Theory	Hypothes	Observations	Confirmation
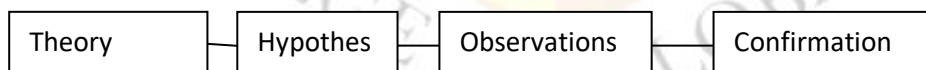
- **Example: -** the general view (Rule) is that "**All Chinese eat snakes**" so, it can be deducted that the Chinese man "**Chao eats snacks**"
- **Another example: -** we know that *all managers are human beings*
- If we also know that *Ravi is a manager*
- Then we can deduce that *Ravi is a human being.*

IMPORTANT TERMS USED IN BUSINESS RESEARCH:-

VARIABLES (Dictionary meaning-*changing* or *changeable*)

A variable is anything that can change in its quantity or value.

Variable is an attribute on which thing vary or change.

Example: - sales, profits, etc.

CONSTANTS (Dictionary meaning *fixed* or *not changeable*)

A Constant is anything that cannot change in its quantity or value.

Example: - phone number, names of things and individual

ATTRIBUTES

An attribute is a specific value on a variable.

Example: - 1. The attribute of variable *GENDER* is *MALE or FEMALE.*

2. The attributes of variable *AGREEMENT* is *SA (strongly agree)/A/ NEUTRAL/D/SD.*

PROPOSITIONS :-

Propositions serve to bring together the concept of the theory.it is a broad statement drawn from a theory.it is a statement about observable phenomena that may be judged as true or false.

TYPES OF VARIABLES

1. **INDEPENDENT VARIABLES-** It is *cause* or *influencing* variable.

2. **DEPENDENT VARIABLES –**It is *effect* or *influenced* variable.
   Example:-
   Increase in poverty leads to **Increase in crimes**- here the variable **increase in poverty** is **independent variable** and **increase in the crime** is **dependent variable**.

3. **INTERVENING VARIABLES**- a factor theoretically affects the conversation or results but cannot be seen, measured, or manipulated.

4. **MODERATING VARIABLES-** these are certain variable which helps to establish relationship between independent variable and dependent variable.it forms strong conditional/background effect on the relationship of the independent and dependent variables. **For example: -**the relationship between training and performance of employees in an organization. Training is independent variable and performance as dependent variable; another variable influences the relationship is interest for study which has a strong effect on this relationship.

5. **Extraneous variables**

   These are variables which are outside or external to the situation under study but influence the outcome of an experiment.

HYPOTHESIS

A hypothesis is specific statement of prediction for an observable phenomenon and it is formulated for empirical testing. ***Hypothesis is a tentative solution /explanation /a guess / assumption/statement to the problem facing the researcher***. Hypothesis may or may not real solution or finding to the problem. **Example: - students** from IIMs are placed faster than other B schools.

STAGES IN HYPOTHESIS

1. Feeling/finding the problem
2. Formulation of hypothesis
3. Deductive development of hypothesis using deductive reasoning
4. Verification/testing of the hypothesis.

QUALITIES OF A GOOD HYPOTHESIS

1. Should be Empirically verifiable
2. Should be Relevant
3. It must have Predictive and explanatory power
4. It must furnish a base for inference
5. Should be consistent with the established knowledge.
6. Should be simple,clear,definite and certain
7. Must be amenable (suitable) to available techniques of analysis.

TESTING / VERIFICATION OF HYPOTHESIS

- Verification means testing of the truth of the hypothesis in the light of fact.
- Testing is used to accept or reject the hypothesis using a sample from the distribution.
- if the hypothesis *agrees* with the facts, it is said to be true and may be accepted as te explanation of the facts.
- If it *disagrees*, it is said to false hypothesis and it should be rejected or modified.
- Testing is done by using statistical methods.
- the null hypothesis(base /exact hypothesis)(H_0)is compared with alternative hypothesis(H_1)

PROCEDURE /STEPS/PHASES OF TESTING OF HYPOTHESIS

1. Select a sample and collect the data
2. Convert the variables/attributes into statistical form such as mean, Standard deviation etc.
3. Formulate hypothesis
4. Select appropriate test for data- t-test,f-test,etc
5. Perform computations.
6. Draw inferences of accepting or rejecting the null hypothesis.

TYPES OF HYPOTHESIS

1. Descriptive hypothesis - describes some characters of an object, situation, etc.
E.g.:- there is less industry-institution interaction in our country
2. Relational hypothesis – describes he relationship between two variables
E.g.: - more cohesive the group, better is the output
3. Working hypothesis- framed in the early stages of research.it may be altered or modified as investigation proceeds
E.g.:- as of now "demand and quality are related". Later this may be replaced as investigation proceeds
4. Null hypothesis- it states that there is no difference between the parameter and statistic that is being compared.
E.g.:-there is no relationship between academic excellence and success in business field.
5. Analytical hypothesis- specifies the relationship between changes in one property leading to change in another.

E.g.:- income level related to number of children in family

6. Statistical hypothesis- these are developed from samples that are measurable.

   a) *Hypothesis which indicates difference*.
      E.g.:- there is difference between the performance of executives in public sector and private sector.
   b) *Hypothesis which indicates association*
      E.g.:- there is a perfect relationship between price and demand

7. Common sense hypothesis – based on what is being observed.

   E.g.:- urban labourers are better paid than rural labourers

PROBLEM DEFINITION

The problem identification lies at the core of a research process.

● Existence or recognition of problem motivates research, without a problem research cannot be preceded. A well-defined problem will yield fruitful result.

● A *Problem* is defined "some difficulty experienced by the researcher in the theoretical or practical situation. Solving this difficulty is the task of research."

● The *Problem* is expressed in interrogative form (question form) eg:- why BCom degree course more popular than other UG courses?

CRITERIA OF A GOOD RESEARCH PROBLEM

1. Originality
2. Clarity and unambiguity
3. Interest and curiosity
4. Important and applicable
5. Feasibility with researcher's abilities
6. Cost and time feasibility

SOURCES OF PROBLEM

1. Personal, professional and academic experience

2. Review of literature

3. Conferences, seminar, etc.

4. Imagination and creativity.

5. Technical and social changes

SELECTION AND DEFENITION OF PROBLEM

The problem can be stated in two ways

   a) As an interrogative statement, or
   b) As a declarative statement

   The Following *steps* can be followed when defining the problem:
   1. Develop a ***conceptual framework*** of the problem - Find out the very root of the problem
   2. State the ***unit of analysis*** - *Units* are the *samples* from whom data are collected)
   3. ***Determine the essential and relevant variables-*** Variables should clearly be identified and narrated to suit the techniques of research
   4. ***Specify the relationship*** which in his opinion exists between the variables.
   5. ***Developing a hypothesis.***

RESEARCH DESIGN-MEANING AND DEFINITION

⦿ Research design is a plan, structure and strategy of investigation proposed to be undertaken.

⦿ **Pauline v Young defines** – "it is the logical and systematic planning and directing piece of research.

⦿ It consist of making a series decisions with respect to *what, why, where, when, who, how* of the research.

⦿ Research Design is also known as *outline, research plan, research blue print*

RESEARCH DESIGN-FEATURES

1. Research project's blue print.
2. Frame work for data collection and analysis.
3. Plan of action of research work- from inception to preparation of research report.
4. Outline and scheme of the operation of variables
5. Strategy of collecting and analysing the data.
6. Estimate of research project-time and cost

RESEARCH DESIGN- NEED

1. As a blue print for research study
2. Enables to channel energies in a specific
3. Stops unnecessary directions and tangents.
4. Answer to various research questions

COMPONENTS OF A RESEARCH DESIGN

Research design provides greater clarity to the thoughts and actions of the researcher. It is very much like having a building plan before the building is constructed. Usually the contents of a research design are as follows:

1. **Need for the study** – the research design should explain need and importance of study
2. **Literature review** – review the previous works done on this topic, understand what they did, and identify gaps
3. **Statement of the problem**- state the research problem in clear terms
4. **Research objectives** – the objectives you want to achieve by this study
5. **Formulation of hypothesis** – so that they can be tested
6. **Operational definitions** – if the study is using uncommon concepts or unfamiliar tools or using even familiar tools and concepts, they must be specified
7. **Scope of the study** – it should define the scope of study which includes geographical scope(territorial area), content scope(aspects to be studied) and chronological scope(time period selection)
8. **Sources of the data**- researcher have to decide the sources from which the data are to be collected- sources may be primary source or secondary source.
9. **Methods of data collection** – he has to determine whether census method or sampling method is to be employed.
10. **Tools and techniques of data collection** – like observation, interview, survey, schedule, questionnaire, etc.

11. **Sampling design** – sampling techniques, size of sample, the way samples are to be drawn etc. are to be decided.
12. **Data analysis** – researcher has to determine the type of techniques used for analysing the data and testing the hypothesis
13. **Presentation of the result of the study** – the format of research report and decision on chapterisation should be taken in advance.
14. **Time estimates**- time taken to complete each research activity should be spelt out
15. **Financial budgets** – the cost estimate
16. **Administration of the enquiry** – this involves identification of research personnel and the type of training to be given to them. How to co-ordinate the various activities also forms part of the research administration

TYPES OF RESEARCH DESIGN:-

- Three types:-

1. **Exploratory Research Design**- It is the plans or blue print to conduct exploratory research. Exploratory research means discovery of new facts, things, forms or ideas.

2. **Descriptive Research Design-** This design is for describing what is going on or what exist about the problem. Here researcher suggests solutions to the problems, and the data can be used for predictions about various phenomenon.

3. **Causal Research Design-** It is designed to looks at cause and effect relationship**.** It is designed to determine whether one or more variables causes or effects one or more outcome variables.

EXPLORATORY RESEARCH –MEANING

- Exploratory research means discovery of new facts, things, forms or ideas.

EXPLORATORY RESEARCH –FEATURES

1. Flexible
2. No use of structured form for data collection
3. No experimentation
4. Low cost
5. Wide exploration of views
6. Interactive and open ended.
7. Theoretical base to a hypothesis.

EXPLORATORY RESEARCH –METHODS

- Four methods:-
1. **Experience survey method**- here the experiences of people in a particular field , are studied by establishing rapport with them.

2. **Secondary data analysis-** already published or unpublished data, literatures are studied. Secondary data may be :-

    1. Internal (data within the organization itself)

    2. External (data from outside secondary sources)

3. **Case study –** It is a thorough investigative study of all the aspects relating to a situation, an event, happening, an organization, a system, a cultural entity or a community. Case histories**,** insight or in-depth studies are conducted in the case study.

4. **Pilot study by focus group interview-** It is interview with several people or groups on a specific topic. There will be a **facilitator/moderator,** and **members of the group**

CASE STUDY METHOD

It is a thorough investigative study of all the aspects relating to a situation, an event, happening, an

Organization, a system, a cultural entity or a community.

Case histories**,** insight or in-depth studies are conducted in the case study

CASE STUDY METHOD- FEATURES

1. Study of a social unit in its entirety.
2. Contact with specific field
3. The subject of the study is recognized as a unit
4. Time consuming
5. Study of insight stimulating examples

CASE STUDY- SOURCES

1. Personal documents
2. Life history
3. Additional sources – books, magazines, literature and previous studies, government documents, communications.

PILOT STUDY BY FOCUS GROUP

It is interview with several people or groups on a specific topic. There will be a **facilitator/moderator,** and **members of the group**

PILOT STUDY BY FOCUS GROUP- FEATURES

1. Form of group interview
2. Moderator will guide the session
3. There will be several participants.
4. Emphasizes on specific theme or topic for in depth study.
5. Participants are interviewed in an unstructured way.

HOW TO CONDUCT PILOT STUDY BY FOCUS GROUP – BEGINNING STEPS

1. Tape recording and transcription.
2. Decide the number of groups to be contacted
3. Decide the size of group (number of members in each group)
4. Decide the level of moderator involvement
5. Select participants.
6. Asking questions

TYPES/CLASSES OF FOCUS GROUP

1. **Two way focus group**- under this , one group will listen ,other group will react
2. **Dual moderator group**- one moderator conduct the discussion smoothly, another asks specific questions.
3. **Duelling moderator focus group –** two moderator stand on against sides , to discuss pros and cons
4. **Respondent moderator groups –** moderator select one participant as temporary moderator.

DESCRIPTIVE RESEARCH DESIGN

⦁ This design is for describing what is going on or what exist about the problem. Here researcher suggests solutions to the problems, and the data can be used for predictions about various phenomenon.

DESCRIPTIVE RESEARCH DESIGN –STEPS

1. Formulating research questions
2. Selecting relevant sites and subjects
3. Collection of relevant data
4. Interpretation of data
5. Writing up findings/ conclusions

CAUSAL RESEARCH DESIGN/EXPERIMENTAL RESEARCH DESIGN

⦁ It is designed to looks at cause and effect relationship**.** It is designed to determine whether one or more variables causes or effects one or more outcome variables.

COMPONENTS OF CAUSAL RESEARCH DESIGN

1. The research problem
2. The research question
3. The program(cause)
4. The units
5. The outcomes (effect)
6. The design

EXPERIMENTAL METHOD

- It is based on experiments

- It is observing the effect on a dependent variable of the manipulation of an independent variable.

EXPERIMENTAL METHOD – FEATURES

1. Isolation of factors or controlled observations
2. It can be repeated under similar conditions(replicated one)
3. Quantitative measurement of results.
4. Cause and effect relationship determination precisely

EXPERIMENT –TYPES

1. Laboratory experiment – it is taken place in a laboratory. Researcher creates here an artificial /simulated condition.
2. Field experiment – it takes place in real life situations .

EXPERIMENTAL DESIGNS –TYPES

1. **Purely post designs** – the dependent variable is measured after exposing the test units to the experimental variables. e.g.:- students experimented are mingled with another un experimented students, and the difference drawn out.
2. **Classical experimental designs-** this design contains (1) random assignment to the experimental and control groups.(2) are testing the both (3) manipulation of the experimental treatment (4) post testing of the two groups (4) compute the difference.
3. **Quasi experimental designs –** it is an experimental design without random assignment.

Statistical designs/ factorial designs – here a factor is a major independent variable ,the researcher examine that which feature of factor has effect on the variable

MERITS AND DEMERITS OF EXPERIMENTAL METHODS

<u>MERITS</u>:-

1. Scientific method
2. Determination of cause and effect relationship
3. Greater accuracy and precision
4. Useful in testing hypothesis.

<u>DEMERITS</u>

1. Difficult of setting
2. Difficulties to get cooperation from people.
3. Difficulties in controlling all the factors

VALIDITY OF FINDINGS AND TYPES OF VALIDITY

<u>MEANING VALIDITY:</u> –

"Whether a measurement of a concept really measures that concept" is known as the concept of *validity.* A measuring instrument is said to possess validity to the extent that it can measure the true differences between the characteristic or variable under study.

E.g.:- if we say "university examinations cannot accurately measure the level of knowledge of a student" it is the comment about the concept of validity.

TYPES OF VALIDITY:-

1. **Face validity -** It explains whether the measure devised of a *concept actually reflect the concept.*

2. **Internal validity** – It shows the authenticity (believability) of what the independent variable really is responsible for the variation that has been identified in the dependent variable. It tests the authenticity of the cause and effect relationship

3. **External validity** – It seeks that whether the result of a study can be generalized beyond the specific research context. It refers to the generalizability of research findings to the external environment.

4. **Content Validity** – It measures the representatives of the content of the instrument. It is the extent to which the instrument provides adequate coverage and representation to the characteristic being measured 'The more the scale items represent the domain or universe of the concept being measured, the greater the content validity.

5. **Measurement validity/Construct (idea) Validity** – It refers to *the degree to which the actual program reflects the idea.*

    It is concerned with the factors that account for difference or variance in the measurement sores. This validity tests the extent to which the scores obtained relate to the theory around which the instrument has been designed.

    a. If the results obtained conform to some existing theory then it has **Convergent validity**. here the validity of a measure is assessed by comparing it to measure of same concept developed through other method.

    b. Alternatively the extent to which the instrument scores separate it from known constructs or theories is referred to as **Discriminant validity** – the validity of measure is assessed not by similar but by dissimilar patterns by other methods.eg:- for testing arithmetical skills, verbal ability measurement test scores also assessed.

6. **Criterion- Related Validity (empirical validity)** – It is established when the measure successfully differentiates individuals or object on a criteria it is supposed to predict.
    It involves establishing either concurrent validity or predictive validity

    a. **Concurrent validity-** It refers to the ability of the instrument to distinguish between groups that it should theoretically be able to distinguish between.
    e.g; if the instrument is administered to a group of prospective employees and it is able to distinguish between people with work experience and no experience then it possesses concurrent validity.

    b. **Predictive validity** – It differentiates between individuals with respect to some future criterion e.g. an opinion instrument that correctly forecasts the outcome of student election in a university has good predictive validity.

7. **Ecological validity** – It seeks the practicability of findings in the daily life of human being. If some findings may be technically valid. But they have little to do with daily real life of human being, and then we say that the findings are *ecologically invalid*.

MEASUREMENT AND SCALING

The word scale or scaling is generally used for indicating measurements or measuring something. Many aspects of social phenomena like emotion, attitude, faiths etc. are not measurable directly. They are not quantitative in nature. In social phenomena there are two types of variables quantitative and qualitative.

Measurement or scaling implies conversion of qualitative data into quantitative data and then measuring them. Various kinds of statistical measurements are used for this purpose.

SCALING

It is an attempt to bring about greater accuracy which is desired in both physical and social sciences.

Essentials of Scaling (Criteria for Good Scaling)

Continuum - means judging the scalability of the phenomenon under study.

Reliability - means that it should consistently produce the same result when applied to the same design.

Validity - implies correct measurement. A scale is valid if it measures correctly what is expected to measure.

Weighting items - means proper weights are to be provided to the attributes involved in the study because they are not of equal importance.

Equality of units - is a desirable characteristic but not essential for sound scientific procedure.

In order to make the units equal, sometimes subtraction or addition can be made.

MEASUREMENT

Measurement is a systematic way of assigning numbers or names to objects and their attributes. It is easy to assign numbers in respect of properties of some objects, properties like weight, height.

Why Measurement?

"When you can measure what you are talking about and express it in numbers, you know something about it" Lord Kelvin

Rules of Measurement

• A rule is a guide which instructs us to do.

• Operational definitions help us to specify the rules for assigning the numbers.

SCALES

Scales are devised for measuring variable in social science research. Scaling is the procedure for determining the quantitative measure of abstract concepts like leadership style, brand image of product etc. It is therefore any series of items which is progressively arranged according to value or magnitude into which an item can be placed according to its quantification.

• A continuous spectrum or series of categories

• Used to represent, usually quantitatively, an item's or person's place in that spectrum

Scale Classification

(A) Level of Measurement

I. Nominal scales

II. Ordinal scales

III. Interval scales

IV. Ratio scale

• **Nominal Scale**
• Numbers or letters assigned to objects which serve as labels for identification or classification. They are Scales "in name only"

• **Ordinal Scale**
• Arranges objects or alternatives according to their magnitude in an ordered relationship. E.g. rating career opportunities as excellent, good, average poor or very poor

Interval scales

Not only indicate order, they also measure order or distance in units of equal intervals. When an interval scale is used to measure psychological attribute, the researcher can comment on the magnitude of differences or compare the average differences on attributes that are measured, but cannot determine the actual strength of the attitude towards an object

• **Ratio Scale**
• A ratio scale has equal interval properties of an interval scale but has two additional features:
• Has a true zero. Possible to indicate the complete absence of a property.
• The numerals of the ratio scale have the qualities of real numbers and can be added, subtracted, multiplied, Divided and expressed in ratio relationships.

SCALING TECHNIQUES

Some of the important scaling techniques are as follows:

☐ **Rating Scale**:
  - Most common form of scales
  - Respondent places the person or object that is being evaluated along a continuum, where each point on the continuum signifies a score value.
  - The scale can be presented in a graphic form or in a statement form.
    i.   Graphic Rating Scale
    ii. The Itemized Rating Scale

☐ **Ranking Scales**:

  - Used to tap preference between two or more objects or persons. i.e. the objects are ranked after comparing one against another or more.
  - Popular ranking scales are paired comparison scale, rank order scale, constant sum scale

. There are **two** generally used approaches of ranking scales namely.
1. *Method of Paired Comparison* where the respondent can express his attitude by making a choice between two objects.
2. *Method of Ranking Order* where the respondents are asked to rank their choices.

☐ **Attitude Scales**: In this type of scale, the attitude of an individual towards a matter can be known from the score of his responses given on a questionnaire. The score will place him in a scale. He simply expresses his likes or dislikes, agreement or disagreement with the issue involved as given in the forms of questions. On the basis of reply, he is assigned a score which indicates his position. In the attitude scale some relevant statements are to be considered by the respondents. The statements are found in such a way as to be intimately related to the attribute which is sought to be measured.

☐ **Factor Scaling:** This is a type of scaling in which multi dimensions of a complex attitude is identified

GOODNESS OF MEASURES

Any instrument that meets the test of reliability, validity and practicality is said to possess the goodness of measure.

1. **VALIDITY**

   "Whether a measurement of a concept really measures that concept" is known as the concept of *validity.* A measuring instrument is said to possess validity to the extent that it can measure the true differences between the characteristic or variable under study.

   Validity of an instrument can be tested on three points.

   a. Content validity
   b. Criterion validity and
   c. Construct validity

2. **RELIABILITY**

   It refers to the degree to which an instrument supplies consistence results. Reliability is gauged on the basis of stability and consistency.

   a. **Stability-** a measure is considered stable if it delivers consistent results with repeated measurement of the same person using the same instrument.
   b. **Consistency** – internal consistency reliability is used to assess the homogeneity or correlation between set of items when several items are summated to form a total score of the scale.

3. **PRACTICALITY**

   From an operational view point it is necessary that the instrument is practical also**.**

   a. **Economy** – a balance has to be struck between the research project and research results.
   b. **Convenience** – a good instrument is easy to administer.
   c. **Interpretability** – it should be easy to interpret the scores given by the instrument.

   - **SOURCE OF ERROR IN MEASUREMENT**

     1. Respondents reluctance
     2. Situational (surrounding) factors affecting the opinion of respondents.
     3. Transient personal factors like state of health, mood, fatigue etc. .of respondents
     4. Defective instruments
     5. Mechanical errors

$\longrightarrow$ **DATA COLLECTION**

● **DATA**

- Data is quantitative or qualitative fact collected for study and analysis in the research

● **NEED OF DATA**

- Data is required to make a decision in any business situations

● **TYPES OF DATA**

1. **Primary data** – These are original data which are collected for the first time for a specific purpose.
2. **Secondary data** – These are data which already collected by others .they are available in the form of published or unpublished sources.

METHODS OF PRIMARY DATA COLLECTION

1. Survey	8. Panel method
2. Observations.	9. Schedule Mail survey
3. Interview	10. Projective technique
4. Questionnaire	11. Sociometry
5. Experimentation	12. Focus group discussion
6. Simulation	13. Content analysis
7. Use of telephone	

SURVEY

● The essence of survey method can be explained as "questioning individuals on a topic or topics and then describing their responses".

● In business studies, survey is the method of primary data collection which is used in order to test concepts, reflect attitude of people, establish the level of customer satisfaction, and conduct segmentation research and a set of other purposes. Survey method can be used in both, quantitative, as well as, qualitative studies.

● **Types of Survey**

1. **Cross-sectional studies** or **cross-sectional analysis**
- It is an observational research type that analyses data of variables *collected at one given point of time* across a sample population.
- This study type is also known as cross-sectional analysis, transverse study or prevalence study.
- The data gathered in a cross-sectional study is from people who are similar in all variables except the one variable which is under study.

2. **Longitudinal studies:**
- It is an observational study that employs *continuous or repeated measures to follow particular individuals over prolonged period of time often years or decades*.
- Longitudinal study collects data that is either qualitative or quantitative in nature.
- In longitudinal study a survey creator is not interfering with survey respondents.

- Survey respondents are observed over a period of time ranging from months to even decades to observe any changes in them or their attitude.

3. Correlational studies:

- It is a non-experimental type of research design where two distinct variables are studied and a statistical analysis is run to study relation between them without the interference of external "variables".

OBSERVATION

Monitoring and recording of behavioural and non-behavioural activities and conditions in a systematic manner to obtain information about the phenomena of interest.

Types of observation:-

On the basis of structure

1. Structured observation – the problem has been clearly defined, so the behaviour to be observed is specified
2. Unstructured observation – it is used in situations where the problem has not been clearly defined hence it cannot be pre specified that what is to be observed.

On the basis of concealment

3. Disguised observation – the subjects are unaware of the fact that they are being observed.
4. Undisguised observation - the subjects are aware of the fact that they are being observed.

On the basis of participation.

5. Participant observation – if the observer participates in the situation while observing
6. Non-Participant observation – the observer remains outside the setting and does not involve himself or participate in the situation.

On the basis of setting/environment

7. Natural observation – the behaviour is observed as it takes place in the actual setting.
8. Contrived observation – the phenomena is observed in an artificial or simulated setting.

On the basis of mode of administration

9. Personal observation – the observer himself monitors and records the behaviour as it occurs.
10. Mechanical observation – mechanical devices, instead of humans are used to record the behaviour. These devices record the behaviour as it occurs and data is sorted and analysed later on.
11. Audit – it is the process of obtaining information by physical examination of data.
12. Content analysis – it may be that we interview then analyse the content of the responses; we may choose to analyse writing, films, social media text, etc.

Conducting an observation study – steps
1. Specify the type of study.
2. Specify the contents of observation.
3. Observer training.
4. Develop an observation form.

EXPERIMENTAL METHOD

It is the least used method for collecting primary data. This method is commonly used by Marketers in test marketing.

Types;
1. Laboratory experiments
2. Field experiments

● **Laboratory experiment**

A laboratory experiment is an investigation conducted in situation created specifically for that Purpose

● **Field experiment**

This is an experiment conducted in real life situation in which the experiments manipulate an Independent variable in order to test a hypothesis

ADVANTAGES OF EXPERIMENTAL METHOD

• The power to determine the causal relationship between variables is more compared with other methods
• The human errors can be reduced to the minimum
• It helps to produce exact measurement

● **Limitations of experimental method**
• Difficult to establish comparable control & experimental group
• Limited scope
• Lacks realism
• Cannot be used for future study
• Not used for determine opinion, motive & intention of individual

DESIGNING QUESTIONNAIRES

• In this method a questionnaire is sent (usually by post) to the persons concerned with a request to answer the questions and return the questionnaire.

• A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms.

• The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself.

CONSTRUCTION OF QUESTIONNAIRE

Essentials of a good questionnaire:

- To be successful, questionnaire should be comparatively short and simple i.e., the size of the questionnaire should be kept to the minimum.
- Questions should proceed in logical sequence moving from easy to more difficult questions.
- Personal and intimate questions should be left to the end. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire.
- Questions may be dichotomous (yes or no answers), multiple choice (alternative answers listed) or open-ended. The latter type of questions are often difficult to analyse and hence should be avoided in a questionnaire to the extent possible.

- There should be some control questions in the questionnaire which indicate the reliability of the respondent.

Type of Questions:-

1. **Open-Ended questions**

   • The respondent is asked to provide his or her own answers.

   • Open-ended questions must be coded before they can be processed for computer analysis.

2. **Closed-Ended Questions**

   • Also known as *structured question*

   • The respondents are offered a set of answers from which they are asked to select one that most closely represent their views.

• The response categories should be exhaustive and mutually exclusive.

• A structured question may be multiple-choice, dichotomous, or a scale.

3. **Multiple-Choice Questions**

• The researcher provides a choice of answers and respondents are asked to select one or more of the alternatives given.

4. **Dichotomous Questions**

• It has only two response alternatives:

Yes or no, agree or disagree, and so on.

Often, the two alternatives of interest are supplemented by a neutral alternative, such as

"No opinion," "don't know," "both," or "none."

5. **Contingency Question**

A survey question is intended for only some respondents, determined by their responses to some other questions.

INTERVIEW

Verbal conversation between two people with the objective of collecting research relevant information from the respondent.

Types of interview:

a. **Personal interview** – face to face two way communication between the interviewer and the respondent.

Method of conducting a personal interview:-

1. Rapport building

2. Introduction

3. Probing

 4. Recording

5. Closing

b. Telephone interview – information is collected from the respondent by asking the questions on phone.

The advantages of telephone interview are:-

1. Low cost

2. Faster collection of data

3. Reduces biases caused by personal presence of interviewer

 c. Focus Group Interview – a kind of unstructured interview which involves a moderator leading a discussion between a small group of respondents on a specific topic.

d. Depth interviews. – An unstructured type of interview used to collect qualitative data. It involves a one to one interaction between the interviewer and respondent.

e. Projective techniques – projective techniques involve highly unstructured and indirect form of questioning. The central feature of all projective techniques is the presentation of an ambiguous, unstructured object, activity or person that a respondent is asked to interpret and explain.

Some of the projective techniques are:-

i)   Thematic Apperception Test(TAT)
ii)   Item Substitution Test
iii)   Word Association Test
iv)   Rorschach Test
v)   Cloud Picture Test
vi)   Sentence Completion Test
vii)   Story Completion Study.

SCHEDULE

This method of data collection is very much like the collection of data through questionnaire, with little difference which lies in the fact that schedules (proforma containing a set of questions) are being filled in by the enumerators who are specially appointed for the purpose.

Contents of Schedules

The schedule is divided in to three parts;

1) Introductory part: it includes:

(a) The introductory information about the problem under investigation and the respondent such as the name, serial number etc. of the survey

(b) General information about respondent like address, age, sex, education, income etc.

(c) The date, place and time of interview.

2) Main schedule: It consists of titles, columns, questions and blank tables that is meant for securing information from respondents in respect of the problem under investigation.

3) Instructions: Here, the researcher is given direction regarding the method of interview.

Difference between Questionnaire and Schedule

1. Questionnaire is generally sent through mail whereas a schedule has to be administered by the researcher personally.
2. In questionnaire respondent fills the answers, whereas in a schedule the researcher fills
3. Questionnaire is cheaper while schedule is costlier
4.   Through questionnaire, we can cover a large area, whereas in schedules there is a problem of sending enumerators to far places.
5. The success of questionnaire is dependent on the quality of questionnaire whereas the success of schedule is dependent on the qualities of the enumerators.
6. A questionnaire puts less pressure on respondent while in a schedule the respondent is bound to give answers to all the questions.
7. In case of schedule, the presence of an outsider influences the quality of response.
8. Non response is high in questionnaire.
9. Questionnaire does not allow the researcher to supplement the written answer whereas it is possible in schedules
10. Time required to collect data from a schedule can be predicted
11. Identity of respondent is not sure in questionnaire
12. Questionnaire can be administered only to literate people whereas literate and illiterate can be covered with a schedule
13. The researcher cannot help the respondent in understanding questions in questionnaire; however it is possible in schedule.

SAMPLING DESIGN

Sampling is concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population.

Two advantages of sampling are that
1. The cost is lower and
2. Data collection is faster than measuring the entire population.
          A Sample design is a definite plan for obtaining a sample from a given population

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

Steps in Sampling Design
1. Define the population or universe
2. State the sampling frame
3. Identify the sampling unit
4. State sampling method

5. Determine the sample size
6. Spell out the sampling plan
7. Select the sample

Population – Definition
      "A population can be defined as including all people or items with the characteristic one wish to understand." Because there is very rarely enough time or money to gather information from everyone or everything in a population, the goal becomes finding a representative sample (or subset) of that population.

      Sometimes that which defines a population is obvious. For example, a manufacturer needs to decide whether a batch of material from production is of high enough quality to be released to the customer, or should be sentenced for scrap or rework due to poor quality. In this case, the batch is the population.

      Although the population of interest often consists of physical objects, sometimes we need to sample over time, space, or some combination of these dimensions. For instance, an investigation of supermarket staffing could examine checkout line length at various times, or a study on endangered penguins might aim to understand their usage of various hunting grounds over time.

Sampling Frame/Source list
      It is a representation or a list of all the elements of target population from which the sample is to be drawn. Sampling frame is the operational definition of population that provides the basis for sampling.
Examples of readily available sampling frames are the telephone directory, electoral roll list etc.

SAMPLE SIZE
The number (n) of observations taken from a population through which statistical inferences for the whole population are made.

A lot of **factors** have to be considered while deciding the size of the sample.
They are:
1. Nature of population
2. Complexity of tabulation
3. Problems related with collection of data
4. Types of sampling
5. Basic information
6. Degree of accuracy required for the study.

METHODS OF SAMPLING
    1. PROBABILITY SAMPLING METHODS AND
    2. NON PROBABILITY SAMPLING METHODS

PROBABILITY SAMPLING METHODS
      Probability sampling means that every member of the population has a chance of being selected. It is mainly used in quantitative research. If you want to produce results that are representative of the whole population, you need to use a probability sampling technique.
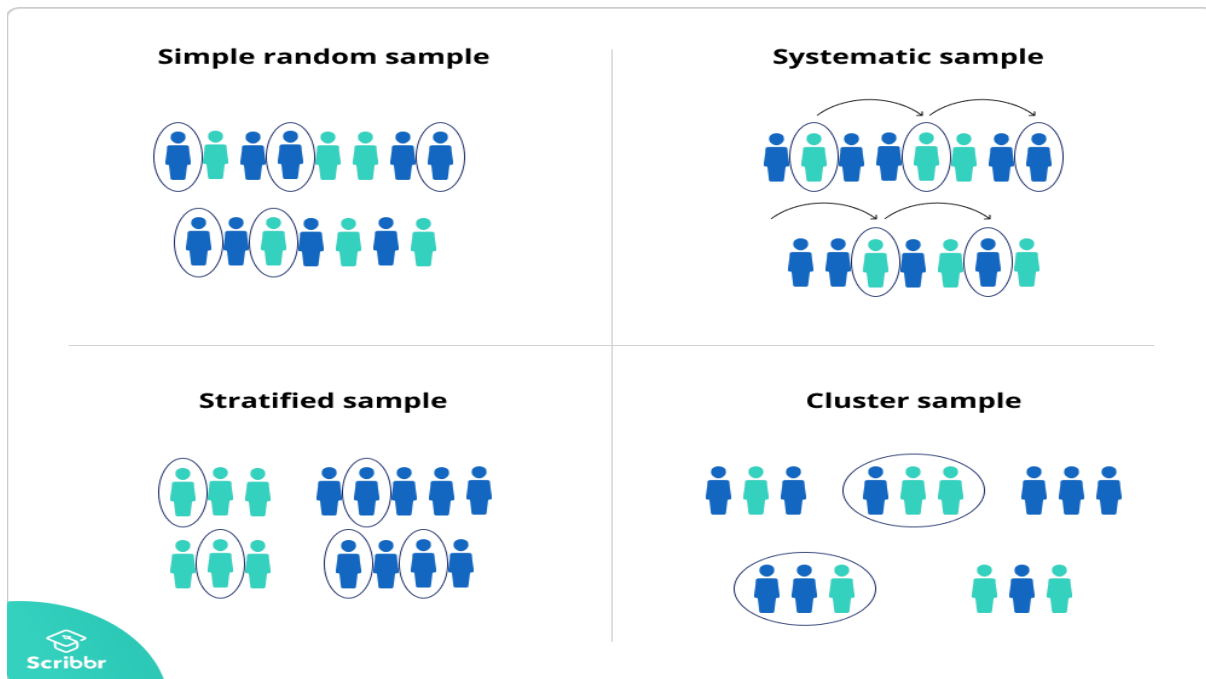
1. Simple random sampling

In a simple random sample, every member of the population has an equal chance of being selected. Your sampling frame should include the whole population. To conduct this type of sampling, you can use tools like random number generators or other techniques that are based entirely on chance.

Example

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

2. Systematic sampling

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

Example

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

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

3. Stratified sampling

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

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

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

Example

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

4. Cluster sampling

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

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

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

Example

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

5. **Multi-stage Sampling:**

• Multi-stage sampling is a further development of the principle of cluster sampling.

• EXAMPLE;-instead of taking a census of all banks within the selected towns, we randomly sample banks from each selected town, and then it is a case of using a four-stage sampling plan.

• If we select randomly at all stages, we will have what is known as 'multi-stage random sampling design'.

Sequential Sampling:

• This sampling design is somewhat complex sample design.

• The ultimate size of the sample under this technique is not fixed in advance, but is determined according to Mathematical decision rules on the basis of information yielded as survey progresses.

Non-probability sampling methods

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

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

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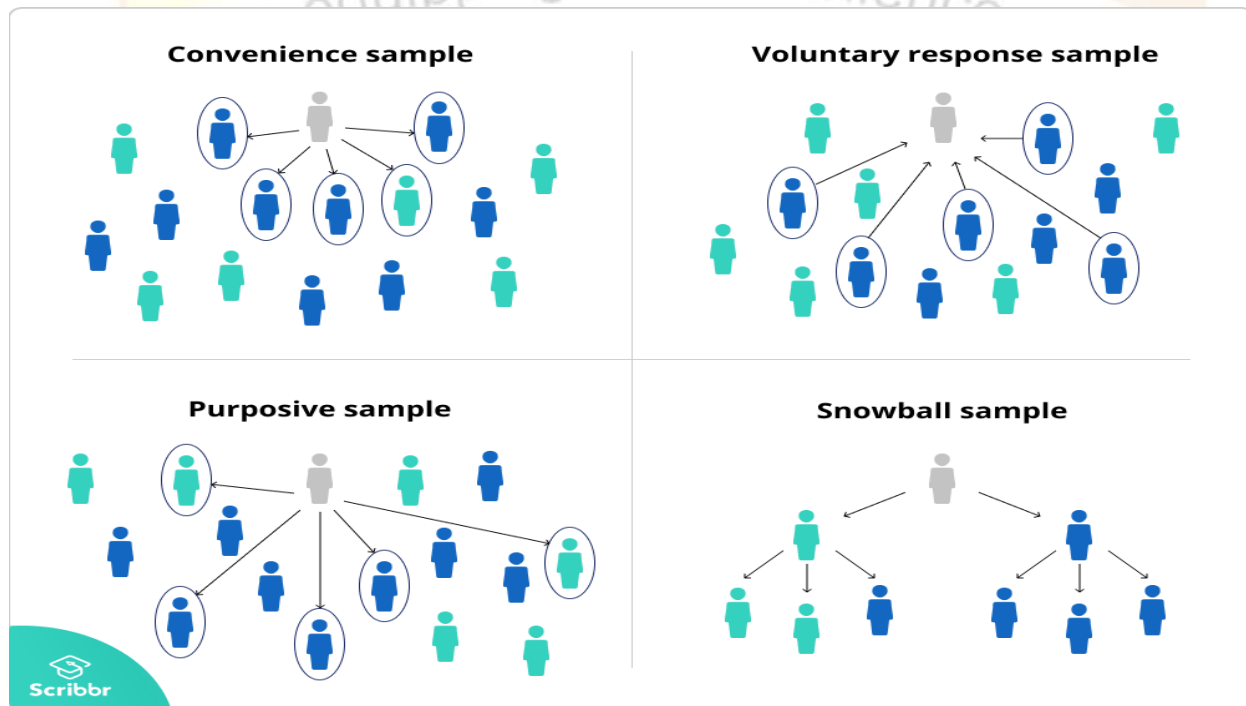
1. Convenience sampling

A convenience sample simply includes the individuals who happen to be most accessible to the researcher. It involves collecting a sample from somewhere convenient to you: the mall, your local school, your church.

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

Example

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

2. Voluntary response sampling

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

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

Example

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

3. Purposive sampling

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

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

Example

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

4. Snowball sampling

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

It is usually done when there is a very small population size. In this type of sampling, the researcher asks the initial subject to identify another potential subject who also meets the criteria of the research. The downside of using a snowball sample is that it is hardly representative of the population.

Example

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

5. Accidental sampling;
• In this method the researcher simply contacts and picks up those cases which he come across and thus continuing the process till the total sample reaches a designated size.

6. Quota sampling
• It is a non-probability sampling technique wherein the researcher ensures equal or proportionate representation of subjects depending on which trait is considered as basis of the quota.

7. Judgmental sampling

• It is more commonly known as purposive sampling. In this type of sampling, subjects are chosen to be part of the sample with a specific purpose in mind.
• With judgmental sampling, the researcher believes that some subjects are more fit for the research compared to other individuals. This is the reason why they are purposively chosen as subjects.

The Factors Considering While Deciding the Size of the Sample
a) Nature of the population.
b) Complexity of tabulation.
c) Problem relate with collection of data.
d) Type of sampling.
e) Basic information.
f) Degree of accuracy required for the study.

Characteristics of Good Sample Design
a. Representative.
b. Viable.
c. The selected sample design should not cause more errors.
d. A good sample design able to control systematic bias efficiently.
e. If the sample is well design and selected, decision makers can use this info with confidence.

Criteria of Selecting a Sampling Procedure
1. Nature of the problem.
2. Goal of researchers.
3. Geographical area covered by the survey.
4. Size of the population under study.
5. Extent of fact available about population.
6. Availability of funds
7. Available time for study.
8. Desired reliability of the result.

Criteria Used For Selecting Sampling Techniques
- The purpose of the survey.
- Measurability.
- Degree of precision.
- Information about population.
- The nature of the population.
- The geographical area covered by the survey.
- Fund availability.
- Time.
- Economy.

Errors in Sample Surveys
Survey results are typically subject to some error. Total errors can be classified into sampling errors and non-sampling errors. The term "error" here includes systematic biases as well as random errors.

Sampling Errors and Biases
Sampling errors and biases are induced by the sample design. They include:
1. Selection Bias: When the true selection probabilities differ from those assumed in calculating the results.
2. Random Sampling Error: Random variation in the results due to the elements in the sample being selected at random.

Sampling Bias
Sampling analysis involve two type of cost namely

      1. cost of collecting data and

      2. cost of an incorrect inference resulting from the data.

There are two causes for incorrect inference resulting from data.

They are

i. Systematic bias

ii. Sampling errors

Causes of systematic bias

- Unsuitable sample frame or source list.
- Faulty measuring device.
- Non respondent
- Indeterminacy principle.
- Usual bias in reporting data.

Sampling errors

The errors which arise due to the use of sampling survey are known as sampling errors. These are random variation in the sample estimate around the true population parameters.

Type of sampling errors:-

Biased errors: These errors are occurring due to the faulty selection of sampling method due to the prejudice of the researchers.

Unbiased errors: This type of bias is occurring due to chance difference between the items included in the sample.

Causes of bias

Bias may arise due to,

1. Faulty process selection.

2. Faulty work during the collection of information.

3. Faulty method of analysis.

Non-Sampling Error

Non-sampling errors are other errors which can impact the final survey estimates, caused by problems in data collection, processing, or sample design. They include:

1. over coverage: Inclusion of data from outside of the population.

2. under coverage: Sampling frame does not include elements in the population.

3. Measurement error: e.g. when respondents misunderstand a question, or find it difficult to answer.

4. Processing error: Mistakes in data coding.

5. Non-response: Failure to obtain complete data from all selected individuals.

After sampling, a review should be held of the exact process followed in sampling, rather than that intended, in order to study any effects that any divergences might have on subsequent analysis.

A particular problem is that of non-response.

Two major types of non-response exist: unit non-response (referring to lack of completion of any part of the survey) and item non-response (submission or participation in survey but failing to complete one or more components/questions of the survey). In survey sampling, many of the individuals identified as part of the sample may be unwilling to participate, not have the time to participate (opportunity cost), or survey administrators may not have been able to contact them

DATA PROCESSIING

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

Processing stages

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

1. Editing

2. Coding

3. Classification

4. Tabulation

Editing

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

Practical guidelines for editing

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

1. The editor should familiarize with the copy of instructions given to the interviewers.

2. The original entry, if found incorrect, should not be destroyed or erased. On the other hand, it should be crossed out in such a manner that it is still eligible.

3. Any, modification to the original entry by the editor must be specifically indicated.

4. All completed schedules must bear signature of the editor an d the date.

5. Incorrect answer to the questions can be corrected only if the editor is absolutely sure of the answer, otherwise leave it as such.

6. Inconsistent, incomplete or missing answers should not be used.

7. Sere that all numerical answers are converted to same units.

Coding

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

Steps in coding

1. Study the answers carefully.

2. Develop a coding frame by listing the answers and by aligning codes to each of them. 3. Prepare a coding manual with the detail of variable names, codes and instructions.

4. If the coding manual has already been prepared before the collection of the data, make the required additions for the open ended and partially coded questions.

Coding rules

1. Give each respondent a code number for identification.

2. Provide code number for each question.

3. All responses including 'don't know', 'no opinion'. Etc is to be coded.

4. Assign additional codes to partially coded questions.

Classification

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

1. To organize data in to concise, logical and intelligible form.

2. To take the similarities and dissimilarities s between various classes clear.

3. To facilitate comparison between various classes of data.

4. To help the researcher in understanding the significance of various classes of data.

5. To facilitate analysis and formulate generalizations

Types of classification

A. Classification according to external characteristics
In this classification, data may be classified either on geographical basis or periodical basis.
Classification on geographical basis
In this type of classification, the data that are collected from different places are placed in different classes.
Classification on periodical basis (chronological classification)
In this type of classification, the data belonging to a particular time or period are put under one class. This type of classification is based on period.
B. Classification according to internal characteristics
Data may be classified either according to attributes or according to the magnitude of variables
Classification according to Attributes
In this type data are classified on the basis of some attributes and characteristics.
Simple Classification
If the classification is based on one particular attribute only it is called simple classification. E.g.; classification on the basis of sex.
Manifold Classification
If the classification is based on more than one or several attributes it is called manifold or multiple classifications. in this data are classified in several groups.

C. Classification according variables

Here the data are classified to some characteristics that can be measured. Data are classified on the basis of quantitative characteristics such as age, height; weight etc. quantitative variables are grouped in to two

    a) Discrete variable

      If the variables can take only exact value, it is called discrete variable.

    b) Continuous variable

      The variables that can take any numerical value within a specified range are called continuous variable.

Characteristics of an ideal classification

1. Unambiguity- Classification should be unambiguous. The various classes should be defined properly.

2. Stable- it should not change from enquiry to enquiry

3. Flexibility- classification should have the capacity of adjustment to new situations and circumstances.

4. Homogeneity- each class should contain homogenous items.

5. Suitability- it should be suitable to objects of any statistical enquiry.

6. Exhaustiveness- there should be no item which does not find a class.

Tabulation

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

Objectives of Tabulation

1. To clarify the purpose of enquiry

2. To make the significance of data clear.

3. To express the data in least possible space.

4. To enable comparative study.

5. To eliminate unnecessary data

6. To help in further analysis of the data.

Types of Tables

■ *Simple Table*

Here the data are presented only for one variable or characteristic. Any frequency distribution of a single variable is simple table

■ *Complex table*

In complex table, two or more characteristics are shown. If the study is related to more than two variables, it is called multivariate analysis. They may be of the following tables.

(a) One- way table
   In this type of table, data of only one characteristic will be shown. It means that when one type of information is secured about different groups or individuals, it can be displayed with the help of one- way table
(b) Two- way table
   When mutually related attributes of a phenomenon are to be displayed, two way tables are used. In other words, this table shows two types of characteristics.
(c) Three-way table
   It displays three types of attributes. It is used when three inter- related or mutually related attributes or characteristics of a phenomenon are to be displayed,.
(d) Manifold tables
   When information about different mutually attributes or characteristics of a phenomenon are to be displayed, manifold table is used. Such tables display information about various characteristics or attributes.

Parts of a statistical table

Following are the important parts of a statistical table.
1. Title of the table
   The title of the table is placed above the table. If there are more than one table in a research, each should bear a number for easy reference.
2. Caption or title of the column
   It is also termed as "box head". There may be sub- captions under the main caption.
3. Stub (row heading)
   Stub refers to the title given to rows
4. Body (main data)
   This is the main body of information needed for the research work.
5. End note (foot note)
   This is placed below the table to convey the expansions of abbreviations to caption, stub or main body.
6. Source note
   If the table is based on outside information, it should be mentioned in the source note below.

Validity of Data

   Validity in data collection means that your findings truly represent the phenomenon you are claiming to measure. Data validation means checking the accuracy and quality of source data before using, importing or otherwise processing data.

   Data validation is a form of data cleansing.

ANALYSIS OF DATA

   Analysis of data is considered to be highly skilled and technical job which should be carried out. Analysis of data means critical examination of the data for studying the characteristics of the object under study and for determining the patterns of relationship among the variables relating to its using both quantitative and qualitative methods.

Purpose of Analysis

   Statistical analysis of data saves several major purposes.

1. It summarizes large mass of data in to understandable and meaningful form.

2. It makes descriptions to be exact.

3. It aids the drawing of reliable inferences from observational data.

4. It facilitates identification of the casual factors unde3rlyiong complex phenomena

5. It helps making estimations or generalizations from the results of sample surveys.

6. Inferential analysis is useful for assessing the significance of specific sample results under assumed population conditions.

Steps in Analysis

Different steps in research analysis consist of the following.

1. The first step involves construction of statistical distributions and calculation of simple measures like averages, percentages, etc.

2. The second step is to compare two or more distributions or two or more sub groups within a distribution.

3. Third step is to study the nature of relationships among variables.

4. Next step is to find out the factors which affect the relationship between a set of variables

5. Testing the validity of inferences drawn from sample survey by using parametric tests of significance.

Types of Analysis

1. **Descriptive Analysis**

Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Descriptive statistics is the discipline of quantitatively describing the main features of a collection of data or the quantitative description itself.
Descriptive Analysis may be –
(a) Univariate analysis

Univariate analysis involves describing the distribution of a single variable, including its central tendency (including the mean, median, and mode) and dispersion (including the range and quartiles of the data-set, and measures of spread such as the variance and standard deviation). The shape of the distribution may also be described via indices such as skewness and kurtosis. Characteristics of a variable's distribution may also be depicted in graphical or tabular format, including histograms and stem-and-leaf display.
(b) Bivariate analysis –

Bivariate analysis is one of the simplest forms of the quantitative (statistical) analysis. It involves the analysis of two variables (often denoted as X, Y), for the purpose of determining the empirical relationship between them. Common forms of bivariate analysis involve creating a percentage table or a scatter plot graph and computing a simple correlation coefficient.

(c) Multi variate analysis

In multivariate analysis multiple relations between multiple variables are examined simultaneously. Multivariate analysis (MVA) is based on the statistical principle of multivariate statistics, which involves observation and analysis of more than one statistical outcome variable at a time. In design and analysis, the technique is used to perform trade studies across multiple dimensions while taking into account the effects of all variables on the responses of interest.

2. **Factor analysis**

Factor analysis is a technique that is used to reduce a large number of variables into fewer numbers of factors. This technique extracts maximum common variance from all variables and puts them into a common score.

Factor analysis is part of general linear model (GLM) and this method also assumes several assumptions: there is linear relationship, there is no multi collinearity, it includes relevant variables into analysis, and there is true correlation between variables and factors.

3. **Canonical analysis**

This analysis can be used in case of both measurable and non-measurable variables for the purpose of simultaneously predicting a set of dependent variables from their joint covariance with a set of independent variables.

4. **Cluster analysis**

It is a multivariate method which aims to classify a sample of subjects (or objects) on the basis of a set of measured variables into a number of different groups such that similar subjects are placed in the same group. Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group are more similar to each other than to those in other groups.

5. **Inferential analysis**

Inferential analysis is concerned with the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate some conclusion or conclusions. It is also concerned with the estimation of population values. It is mainly on the basis of inferential analysis that the task of interpretation (i.e., the task of drawing inferences and conclusions) is performed.

COMMON DESCRIPTIVE TECHNIQUES

The most common descriptive statistics used in research are as follows:-

(1) Ratios, percentages and averages

In statistical analysis Ratios, percentages and weighted averages play a very important role. Ratios show the relation of one figure to another. For example, if the total number of students in a school is 2000, and total number of teachers is 250, then the ratio between teachers and students is 250:2000. To make it percentage, multiply by 100.

(2) Frequency Tables

One of the most common ways to describe a single variable is with a frequency distribution. Frequency distribution can be depicted in two ways, as table or as a graph. If the frequency distribution is depicted in the form of a table, we call it frequency table.

(3) Contingency Tables

A Contingency table shows the relationship between two variables in tabular form. The term Contingency table was first used by the statistician Karl Pearson in 1904. Contingency tables are especially used in Chi- square test.

(4) Graphs and Diagrams

Diagrams and graphs is one of the methods which simplifies the complexity of quantitative data and make them easily intelligible. They present dry and uninteresting statistical facts in the shape of attracting and appealing pictures. They have a lasting effect on the human mind than the conventional numbers.

Uses of Graphs and Diagrams

1. They help in presenting quantitative facts in simple, clear and effective pictures.

2. They make the whole data readily intelligible.

3. They can be used for comparison purpose.

4. They are useful in analysing complex economic theories.

5. They save much time in understanding data.

6. Facts can be understood without doing mathematical calculations.

7. They help in locating statistical measures such as median. quartile, mode etc

Types of Graphs

The following graphs are commonly used to represent data

1. Charts or line graphs

2. Bar charts

3. Circle charts or pie diagram

4. Pictograms

1. Line Graphs

A line graph displays information in a series of data points that each represents an individual measurement or piece of data. The series of points are then connected by a line to show a visual trend in data over a period of time. The line is connected through each piece chronologically.

2. Bar charts

The bar graph is a common type of graph which consists of parallel bars or rectangles with lengths that are equal to the quantities that occur in a given data set. The bars can be presented vertically or horizontally to show the contrast and record information. Bar graphs are used for plotting discontinuous (discrete) data. Discrete data contains discrete values and are not continuous.

Histogram

A histogram is a graph of frequency distributions. It is a set of vertical bars whose are proportional to the frequencies. While constructing histogram, the variable is always taken on the x- axis and the frequencies on y-axis.

Frequency Polygon

The frequency polygon is a graph of frequency distribution. Here we draw histogram of the data and then join by straight line and mid points of upper horizontal sides of these bars. Join both ends of the frequency polygon with the x- Axis.

Frequency Curves

A continuous frequency distribution can be represented by a smoothed curve known as Frequency curves

Ogive or Cumulative Frequency Curve

A frequency distribution can be cumulated in two ways, less than cumulative series and more than cumulative series. Smoothed frequency curves drawn for these two cumulative series are called cumulative frequency curves or ogives.

- *Less than ogive curve:*

In less than ogive curve the upper limit per limit of each class interval is taken on x- axis in increasing order. For each such upper limit on x-axis, the cumulative frequency of all the class intervals from the first class interval to last class interval are taken on the y-axis.

- *More than ogive curve:*

In more than ogive curve the lower limit of each class interval is taken on x- axis in increasing order. For each such lower limit on x- axis the cumulative frequency of all the class interval from that class interval to the last class interval are taken on y-axis.

3. Circle Charts or Pie Diagram

A pie graph is a circle divided into sections which each display the size of a relative piece of information. Each section of the graph comes together to form a whole. In a pie graph, the length of each sector is proportional to the percentage it represents. Pie graphs work particularly well when each slice of the pie represents 25 to 50 percent of the given data.

4. Pictograms

A pictogram, also called a pictogram or pictograph, is an ideogram that conveys its meaning through its pictorial resemblance to a physical object. Pictographs are often used in writing and graphic systems in which the characters are to a considerable extent pictorial in appearance. Pictography is a form of writing which uses representational, pictorial drawings.

TOOLS AND STATISTICAL METHODS FOR ANALYSIS

The tools and technique of statistics can be studied under two divisions of statistics.

(A)Descriptive Statistics

In descriptive statistics we develop certain indices and measures of raw data.

They are;

1. Measures of Central Tendency

2. Measures of Dispersion

3. Measures of skeweness and kurtosis

4. Measures of correlation

5. Regression analysis

6. Index numbers

7. Time series analysis

8. Coefficient of association

1. Measures of Central Tendency.

The central tendency of a distribution is an estimate of the "center" of a distribution of values. There are different types of estimates of central tendency such as mean, median, mode, geometric mean, and harmonic mean.

2. Measures of Dispersion.

Dispersion refers to the spread of the values around the central tendency. There are two common measures of dispersion, the range and the standard deviation. It can be used to compare the variability in two statistical series

3. Measures of skewness and kurtosis

A fundamental task in many statistical analyses is to characterize the location and variability of a data set. A further characterization of the data includes skewness and kurtosis. Skewness is a measure of symmetry, or more precisely, the lack of symmetry. A distribution, or data set, is symmetric if it looks the same to the left and right of the center point. Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. That is, data sets with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails.

4. Measures of correlation

Correlation refers to any of a broad class of statistical relationships involving dependence. When there are two variables, the correlation between them is called simple correlation. When there are more than two variables and we want to study relation between two of them only, treating the others as constant, the relation is called partial correlation. When there are more than two variables and we want to study relation of one variable with all other variables together, the relation is called multiple correlations

5. Regression analysis

Regression analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables.

6. Index numbers

An index is a statistical measure of changes in a representative group of individual data points. Index numbers are designed to measure the magnitude of economic changes over time. Because they work in a similar way to percentages they make such changes easier to compare.

7. Time series analysis

A time series is a sequence of data points, measured typically at successive points in time spaced at uniform time intervals. Time series analysis comprises methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data.

8. Coefficient of association

Coefficient of association like, Yule's coefficient, measures the extent of association between two attributes.

(B) Inferential Statistics

Inferential statistics deals with forecasting, estimating or judging some results of the universe based on some units selected from the universe. This process is called Sampling. It facilitates

estimation of some population values known as parameters. It also deals with testing of hypothesis to determine with what validity the conclusions are drawn.

1. Ratios, percentages and averages

In statistical analysis Ratios, percentages and weighted averages play a very important role. Ratios show the relation of one figure to another. For example, if the total number of students in a school is 2000, and total number of teachers is 250, then the ratio between teachers and students is 250:2000. To make it percentage, multiply by 100.

MEASURES OF CENTRAL TENDENCY (AVERAGES)

An average is a single significant figure which sums up characteristic of a group of figures. The various measures of central tendency are;

(1) Arithmetic mean

(2) Median

(3) Mode

(4) Geometric mean

(5) Harmonic mean

Arithmetic Mean

The Mean or average is probably the most commonly used method of describing central tendency. To compute the mean all you do is add up all the values and divide by the number of value.

Median

The Median is the score found at the exact middle of the set of values. One way to compute the median is to list all scores in numerical order, and then locate the score in the center of the sample. For example, if there are 500 scores in the list, score #250 would be the median. It is also, called {(n + 1) ÷ 2}th value, where n is the number of values in a set of data.

Mode

Mode is the value of the item of a series which occurs most frequently. According to Kenny 'the value of the variable which occurs most frequently in a distribution is called a mode". In the case of individual series, the value which occurs more number of times is mode.

INDEX NUMBERS

Index numbers are designed to measure the magnitude of economic changes over time. A statistic which assigns a single number to several individual statistics in order to quantify trends. Index numbers are the indicators of the various trends in an economy. Price index numbers indicate the position of prices whether they are rising or falling and at what rate. Similarly, index numbers regarding agricultural production indicates the trend of change whether it is rising or falling at what rate over a period of time. An index number is an economic data figure reflecting price or quantity compared with a standard or base value. The base usually equals 100 and the index number is usually expressed as 100 times the ratio to the base value

Simple and weighted index numbers

Simple index numbers are those in the calculation of which all the items are treated as equally important. Here items are not given any weight.

Weighted index numbers are those in the calculation of which each item is assigned a particular weight.

Price Index Numbers

Price index numbers measure changes in the price of a commodity for a given period in comparison with another period.

Various methods used for construction of Price index numbers

1) *Simple Aggressive Method*: - This is the simplest method. The prices for base year and current year are only required. The aggregate of current year price is divided by aggregate of base year price and multiplied by 100.

2) *Simple Average Relative Method*: - In this method, price relative for each item is found out. Price relative is 1= current year price ÷ base year price * 100 .The average of these relatives is found out. i.e. price index number =$\sum$ I/n

3) *Weighted aggressive method*: - in this method weights are assigned to each item. The two well-known methods used for assigning weights are known as Laspeyer's method and Paasche's method.

Laspeyer's method: base year quantity is taken as weight.

Laspeyer's index number = $\sum p1q0 / \sum p0q0 * 100$

Paasche's method. : Current year quantity is taken as weight.

Paasche's index number = $\sum p1q1 / \sum p0q1 * 100$

Prof. Irving Fisher has suggested a formula for the construction of index numbers.

Fisher's index number = $\sum p1q0 \sum p1q1 \sum p0q0 \times \sum p0q1$

4) *Weighted Average Of Price Relative Method*: - In this method, we are using some arbitrary numbers as weight. The formula is $\sum IV / \sum V$ where, 'V 'is the weight and I= (p1/ p0)*100

INTERPRETATION

   Interpretation refers to the technique of drawing inference from the collected facts and explaining the significance of those inferences after an analytical and experimental study. It is a search for broader and more abstract means of the research findings. If the interpretation is not done very carefully, misleading conclusions may be drawn. The interpreter must be creative of ideas he should be free from bias and prejudice

Fundamental principles of interpretation

1. Sound interpretation involves willingness on the part of the interpreter to see what is in the data.

2. Sound interpretation requires that the interpreter knows something more than the mere figures. 3. Sound interpretation demands logical thinking.

4. Clear and simple language is necessary for communicating the interpretation

Need for interpretation (importance of interpretation.)

1. It is through interpretation that the interpreter is able to know the abstract principles lying in his conclusions.

2. On the basis of the principles underlying his findings, a researcher can make various predictions about the various other events which are unrelated to his area of findings.

3. Interpretation leads to the establishment of explaining concepts.

4. A researcher can appreciate only through interpretation, why his findings are and what they are.

5. The interpretation of the findings of exploratory research study usually results in to hypothesis for experimental research.

Steps involved in the technique of interpretation

1. Researcher must give reasonable explanations of the relations he have found. He must be able to see uniformity in diversified research findings so that generalization of findings is possible.

2. If any extraneous information is collected during the study, it must be considered while interpreting the final result of research study.

3. The researcher can consult with those having insight in to the study who can point out the omission and errors in logical arguments.

4. The researcher must consider all relevant factors affecting the problem at the time of interpretation.

5. The conclusions appearing correct at the beginning may prove to be inaccurate later. So researcher must not be in a hurry while interpreting.

Errors of interpretation

The errors of interpretation can be classified into two groups.

1. **Errors due to false generalizations**
   Errors occur when
   (i)   Unwarranted conclusions are drawn from the facts available.
   (ii)   Drawing conclusions from an argument running from effect to cause
   (iii)   Comparing between two sets of data with unequal base
   (iv)   Conclusions are drawn from data irrelevant to the problem.
   (v)   False generalizations and faulty statistical methods are made.
2. Errors due to misuse of statistical measures
   When
   (i)   conclusions are based on what is true, on an average.
   (ii)   Percentages are used for comparisons, when total numbers are different.
   (iii)   Index numbers are used without proper care.
   (iv)   Casual correlation is used as real correlation

RESEARCH REPORT

- A report is a detailed description of what has been done and how it has been done with respect to a particular area or topic.
- The purpose of the written report is to present the results of your research, but more importantly to provide a persuasive argument to readers of what you have found.
- It is the end product of a research activity. It is highly skilled work it is the final stage of the research

Need For Research Report

- The aim of research is the search for knowledge.
- A research report is needed to evolve a theory or a principle.
- Reporting is a process through which a basic ground is prepared for exchange of ideas or thoughts.
- Reporting helps the researcher to make specific recommendation for course of action.
- The research ability of a candidate is revealed through the final report he presents.
- A research report is highly useful for policy formulators, practitioners, general public and others.

Functions of Research Report

- Research report serves as a means for presenting the problem studied, methods and techniques used, findings, conclusions and recommendation in an organized manner.
- It serves as a reference material for future use in the same or related area.
- It serves as a means for judging the quality of the research project.
- It is a means for evaluating research ability.
- It provides systematic knowledge on problems and issues analyzed.

Qualities of a Good Report

- Clarity
- Continuity
- Consistency
- Brevity
- Readability
- Interest and Appeal
- Judicious Selection of Materials
- Avoiding personal opinion
- Concentrate on Central Ideas
- Proper Reference

STEPS IN REPORT WRITING

They are to be completed through a number of steps.

1. Plan the project in advance; fix the target and final date of completing the report.
2. The time of report writing should be planned in advance.
3. Arrange the data, documents, bibliography etc. in conformity with the structure of the report.
4. The outline should be based on all main points and sub points.

5. Prepare a rough report of what one has done in his studies. He has to write down the procedure adopted by him in collecting the material, the technique or analysis adopted by him, the broad findings and generalizations and his suggestions.

6. Keep the rough report for few days for careful reading and then revising it on the basis of thinking and discussing with others. It is appropriate to get help of some experienced and knowledgeable person at this stage.

7. Rewrite the report on the basis of the revision made and corrections effected on the report.

8. Prepare final bibliography. Bibliography may contain two parts, first containing name of the books and pamphlets, second containing the names of magazines and newspaper articles.

9. The last step in report writing is the writing of a final draft of the report. The final draft should be written in a concise and objective style and in simple language.

TYPES OF REPORTS

(1) Technical Report

In the technical report the main emphasis is on (i) the methods employed, (it) assumptions made in the course of the study, (iii) the detailed presentation of the findings including their limitations and supporting data.

A general outline of a technical report can be as follows:

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

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

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

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

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

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

7. *Bibliography*: Bibliography of various sources consulted be prepared and attached.

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

(2) Popular Report

The popular report is one which gives emphasis on simplicity and attractiveness. The simplification should be sought through clear writing, minimization of technical, particularly mathematical, details and liberal use of charts and diagrams. Attractive layout along with large print, many subheadings, even an occasional cartoon now and then is another characteristic feature of the popular report.

A general outline of a popular report.

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

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

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

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

5. *Results*: This section constitutes the main body of the report wherein the results of the study are presented in clear and non-technical terms with liberal use of all sorts of illustrations such as charts, diagrams and the like ones.

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

CHAPTERIZATION OF PROJECT REPORT

The entire research work will run into five chapters.

Chapter I. Introduction brings out the importance of the study, and states its objectives and hypotheses. It also includes methodology and limitations.

Chapter II will contain previous reviews, history of the Problems. A Quick look on subjective well-being will also be carried out in chapter II.

Chapter III will be a methodological part of the study.

Chapter IV Analysis and Discussions is to be done in.

Chapter V Findings, Conclusions and Suggestions for further Research will be presented followed by Bibliography and References.

CONTENTS OR LAYOUT OF THE RESEARCH REPORT

The layout of the report means as to what the research report should contain. A comprehensive layout of the research report should comprise;-

(1) Preliminary pages;

(2) The main text;

(3) The end matter.

(1) Preliminary Pages

In its preliminary pages the report should carry a title and date, followed by acknowledgements in the form of 'Preface' or 'Foreword'. Then there should be a table of contents followed by list of tables and illustrations so that the decision-maker or anybody interested in reading the report can easily locate the required information in the report.

Preliminaries include: -

- Title Page

- Researcher's Declaration

- Certificate of the Research Guide

- Acknowledgements

- List of Tables and Figures

(2) The main text

The main text provides the complete outline of the research report along with all details.

Title of the research study is repeated at the top of the first page of the main text and then follows the other details on pages numbered consecutively, beginning with the second page. Each main section of the report should begin on a new page.

The main text of the report should have the following sections:-

(i)   Introduction
(ii)   Statement of findings and recommendations;
(iii)   The results
(iv)   The implications drawn from the results
(v)   The summary.

(3)The end matter.

At the end of the report

1. Appendices should be enlisted in respect of all technical data such as questionnaires, sample information, mathematical derivations and the like ones.

2. Bibliography of sources consulted should also be given.

3. Index (an alphabetical listing of names, places and topics along with the numbers of the pages in a book or report on which they are mentioned or discussed) should invariably be given at the end of the report. The value of index lies in the fact that it works as a guide to the reader for the contents in the report.

ROLE OF AUDIENCE

Audience analysis involves identifying the audience and adapting a speech to their interests, level of understanding, attitudes, and beliefs. The common division of audiences into categories is as follows:

1. Experts
2. Technicians
3. Executives
4. Non specialists

READABILITY

■ The readability of text depends on its content (the complexity of its vocabulary and syntax) and its presentation (such as typographic aspects like font size, line height, and line length).

■ Many experts, through much research, have compiled golden rules of documentation writing. These rules apply regardless of medium:-

  - Use short, simple, familiar words
  - Avoid jargon.
  - Use culture-and-gender-neutral language.
  - Use correct grammar, punctuation, and spelling.
  - Use simple sentences, active voice, and present tense.
  - Begin instructions in the imperative mode by starting sentences with an action verb.
  - Use simple graphic elements such as bulleted lists and numbered steps to make information visually accessible.

COMPREHENSION

Comprehension is the ability to understand and get meaning from spoken and written language.

Causes of Reading Comprehension Failure

■ Inadequate instruction

■ Insufficient exposure and practice

■ Deficient word recognition skills

■ Deficient memory capacity and functioning

■ Significant language deficiencies

■ Inadequate comprehension monitoring and self-evaluation

■ Unfamiliarity with text features and task demands

■ Undeveloped attentional strategies

■ Inadequate cognitive development and reading experiences

FORMAT OF THE REPORT

■ **TITLE PAGE**: - Title of project, Subtitle (where appropriate), Date, Author, Organization, Logo

■ **BACKGROUND**: – History (if any) behind the project

■ **ACKNOWLEDGEMENT:** - Author thanks people and organization who helped during the project

■ **SUMMARY** (sometimes called abstract of the synopsis):- A condensed version of a report – outlines salient points, emphasizes main conclusions and (where appropriate) the main recommendations. N.B this is often difficult to write and it is suggested that you write it last.

■ **LIST OF CONTENTS**: - An at- a – glance list that tells the reader what is in the report and what page number(s) to find it on.

■ **LIST OF TABLES**: - As above, specifically for tables.

■ **LIST OF APPENDICES**: - As above, specifically for appendices.

■ **INTRODUCTION**: - Author sets the scene and states his/ her intentions.

■ **AIMS AND OBJECTIVES AIMS**: - – general aims of the audit/ project, broad statement of intent.

■ **OBJECTIVES**: - specific things expected to do/deliver(e.g. expected outcomes)

■ **METHOD**: - Work steps; what was done – how, by whom, when?

■ **RESULT/FINDINGS**: - Honest presentation of the findings, whether these were as expected or not. Give the facts, including any inconsistencies or difficulties encountered

■ **DISCUSSION**:- Explanation of the results.(you might like to keep the SWOT analysis in mind and think about your project's strengths, weakness, opportunities and threats, as you write)

■ **CONCLUSIONS**: - The author links the results/ findings with the points made in the introduction and strives to reach clear, simply stated and unbiased conclusions. Make sure they are fully supported by evidence and arguments of the main body of your audit/project.

ETHICS IN RESEARCH

Research ethics concerns the responsibility of researchers to be honest and respectful to all individuals who are affected by their research studies or their reports of the studies' results.

The research ethics may be;

■ To protect participants /patients /society /resources /researcher?

■ To ensure accuracy of scientific knowledge

■ To protect intellectual and property rights Breach of ethics in research would amount to scientific misconduct.

Scientific misconduct are;

- Fraud: invention/fabrication of data

- Plagiarism: copying data, ideas, text without acknowledgement of source

- Piracy: infringement of a copyright

- Submitting/Publishing the same paper to different journals

- Not informing a collaborator of your intent to file a patent in order to make sure that you are the sole inventor

- Overworking, neglecting, or exploiting research students

- Making derogatory comments and personal attacks in your review of author's submission

- Making significant deviations from the research protocol approved by the Review Board without informing the committee

- Not reporting an adverse event in a human research experiment

- Including a colleague as an author on a paper in return for a favour even though the colleague did not make a serious contribution to the paper

- Trimming outliers from a data set without discussing your reasons in paper

- Using an inappropriate statistical technique in order to enhance the significance of your research, etc.