Research Design

Research Design

- Research design constitutes the blueprint for the collection, measurement, and analysis of data.

- The planned sequence of the entire process involved in conducting a research study

- Research design is:

  - a plan for selecting the sources and types of information used to answer research questions

    - *WHAT data to collect from WHICH source?*

  - a framework for specifying the relationships among the study variables

    - *WHICH one is the dependent and independent variables?*

  - a blueprint that outlines each procedures

    - *HOW to experiment, analyze and interpret the results?*

- A research design should be able to provide answer to the following queries:

  - What is the study about?

  - Why is the study being made?

  - Where will the study be carried out?

  - What type of data is required?

  - Where can the required data be found?

  - What periods of time will the study include?

  - What will be the sample design?

  - What techniques of data collection will be used?

  - How will the data be analysed?

  - In what style will the report be prepared?

Need of Research Design

o   It reduces inaccuracy;

o   It helps to get maximum efficiency and reliability;

o   It minimizes wastage of time;

o   It is helpful for testing of hypothesis;

o   It eliminates bias and marginal errors

o   It is helpful for collecting research materials;

o   It gives an idea regarding the type of resources required in terms of money, manpower, time, and efforts;

o   It provides an overview to other experts;

o   It guides the research in the right direction.

Cont.

❑ Research design have the following parts:

1) ***Sampling design:*** which deals with the method of selecting items to be observed for the given study

2) **Observational design:** which relates to the conditions under which the observations are to be made

3) **Statistical design:** which concerns with the question of how many items are to be observed and how the information and data gathered are to be analysed

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

- Important features of a research design:

  ➢ It is a plan that specifies the sources and types of information relevant to the research problem

  ➢ It is a strategy specifying which approach will be used for gathering and analysing the data

  ➢ It also includes the time and cost budgets since most studies are done under these two constraints

- In brief, research design must, at least, contain:

  ➢ A clear statement of the research problem

  ➢ Procedures and techniques to be used for gathering information

  ➢ The population to be studied

  ➢ Methods to be used in processing and analysing data

Features of a Good Design

- Good research design is often believed to possess characteristic features like flexibility, appropriateness, efficiency, economically sound and so on.

- Generally, the design which minimizes bias and maximizes the reliability of the data collected and analyzed is considered a good design.

- A research design appropriate for a particular research problem, usually involves the consideration of the following factors:

  - The means of obtaining information

  - The availability and skills of the researcher and his staff, if any

  - The objective of the problem to be studied

  - The nature of the problem to be studied

  - The availability of time and money for the research work

Important concepts relating to research design

- **Variable:** is a characteristic, trait, or attribute of a person or thing that can be classified or measured

  - The condition or characteristic which in a given study may have more than one value

    E.g. weight, height, income

- **Independent Variable:** A variable that is presumed to influence another variable; the variable under study or the one that the researcher manipulates

  – variable that is antecedent to the dependent variable

- **Dependent Variable:** The variable that is expected to change as a result of the manipulation of the independent variable

  – Variable depends upon or is a consequence of the other variable

  – For instance, if we say that height depends upon age, then height is a dependent variable and age is an independent variable.

Cont.

- **Extraneous variable:** Independent variables that are not related to the purpose of the study, but may affect the dependent variable

  – Whatever effect is noticed on dependent variable as a result of extraneous variable(s) is technically described as an *experimental error*

  – A study must always be so designed that *the effect upon the dependent variable is attributed entirely to the independent variable(s), and not to some extraneous variable or variables*.

- **Control:** One important characteristic of a good research design it is to minimise the influence or effect of extraneous variable(s).

Confounded relationship

▪ When the dependent variable is not free from the influence of extraneous variable(s), the relationship between the dependent and independent variables is said to be confounded by an extraneous variable(s).

Research hypothesis

▪ When a prediction or a hypothesized relationship is to be tested by scientific methods, it is termed as *research hypothesis*.

– The research hypothesis is a predictive statement that relates an independent variable to a dependent variable.

– Usually a research hypothesis must contain, at least, one independent and one dependent variable.

Experimental and non-experimental hypothesis-testing research

- When the purpose of research is to test a research hypothesis, it is termed as *hypothesis-testing research.*

- It can be of the experimental design or of the non-experimental design.

  - *Experimental hypothesis-testing research: a r*esearch in which the independent variable is manipulated

  - *Non-experimental hypothesis-testing research : a* research in which an independent variable is not manipulated

Experimental and control groups:

- The control group and experimental group are compared against each other in an experiment.

- The only difference between the two groups is that the independent variable is changed in the experimental group.

  – The independent variable is "controlled" or held constant in the control group.

- While all experiments have an experimental group, not all experiments require a control group.

  – Experiments that use control groups are called *controlled experiments*.

- **Experiment:** The process of examining the truth of a statistical hypothesis relating to some research problem

Types of Research Design

- There are numerous ways to classify research design

- However, a research design can be broadly classified into the following five categories:

  ➢ Exploratory Research Design

  ➢ Descriptive Research Design

  ➢ Correlational Research Design

  ➢ Diagnostic Research Design

  ➢ Experimental Research Design

Exploratory Research Design

- Exploratory research is used for the preliminary investigation of a subject that is not yet well understood or sufficiently researched.

- Exploratory research allows researchers to explore issues in detail in order to familiarize themselves with the problem or concept to be studied.

    - Familiarization with the concept helps researchers in formulating research hypothesis.

- This research is one which has the purposes of formulating a problem for more accurate investigating or for developing a hypothesis.

- Because exploratory research is based on the study of little-studied phenomena, it relies less on theory and more on the collection of data to identify patterns that explain these phenomena.

Descriptive Research Design

- Descriptive research is a type of research that describes a population, situation, or phenomenon that is being studied

- The descriptive research design is used to describe a phenomenon and its different characteristics without necessarily investigating the causes that produce it.

- It focuses on answering the *how, what, when, and where* questions of a research problem, rather than the *why.*

- Researcher does not control or manipulate any of the variables, but only observes and measures them

- If the problem is not clear enough to conduct a descriptive analysis, researchers can use exploratory research methods first

  - Without a clear problem statement, you're not doing descriptive but exploratory research.

    E.g. Do students prefer reading in library or in lab class.

Correlational Research Design

- A correlation refers to an association or a relationship between two entities.

- A correlational research studies how one entity impacts the other and what are the changes that are observed when either one of them changes.

- This research method is carried out to understand naturally occurring relationships between variables.

  o Hence, at least two groups are required to conduct a correlational quantitative research successfully.

- Correlational design allows the researcher to establish some kind of a relation between two closely related topics or variables.

- It's a non-experimental research design type that requires at least two groups of data.

  E.g. Positive correlation- As height increases, weight also increases

     Negative correlation-As water consumption increases, tiredness decreases

     Zero correlation- Water consumption is not correlated with height

Diagnostic Research Design

- Diagnostic research is one of the research design types that aims to examine the underlying cause of a certain situation or phenomenon.

- It can help you find out more about the factors that lead to specific issues or challenges that someone might be experiencing.

- This research design is used to understand more in detail about the factors that are creating problems

- This design usually consists of three research phases:

  - ➢ *Problem inception*: when did the issue arise? In what situations is the issue more evident?

  - ➢ *Problem diagnosis*: what is the underlying cause of the issue? What is influencing the issue to worsen?

  - ➢ *Problem solution*: What is working in curing the issue? Under what situations does the problem seem to become less evident?

Experimental Research Design

- Experimental research, also called experimentation, is research conducted using a scientific approach using two or more variables.

- This is a method used to establish a cause and effect relationship between two variables or among a group of variables.

  - The independent variable is manipulated to observe the effect on the dependent variable.

- Establishes a relation between the cause and effect of a particular happening.

- Most studies under quantitative research methods are experimental in nature.

- The researcher observes the influence of an independent variable on the dependent one.

  - For instance, you can observe the impact of the price (an independent variable) on customer satisfaction (a dependent variable).

Types of Experimental Research Design

Pre-experimental design: basic experimental steps are followed, but there is no control group.

- the researcher studies a single group and does not make any comparisons between this group and an equivalent non-treatment group

- include one or more than one experimental group to be observed against certain treatment.

Quasi-experimental design :looks a little like an experimental design but the subjects are not randomly assigned to the groups

- participants are assigned to groups based on non-random criteria.

True experimental design: considered as the most accurate type of the experimental research because it uses statistical analysis to support or reject a hypothesis.

- participants are randomly assigned to either the treatment or the control group

Sampling

- Sampling is the process of selecting a representative sample from populations

  - The results for the sample are then used to make estimates of the population

- Survey or data collection exercise can be broadly classified into two types, namely:

  - *Census survey*: where data is collected from each member of the population of interest

  - *Sample survey*: where data is to be collected from some selected members of the population

- Why sample needed?

  - The population of interest is usually too large to attempt to survey all of its members.

  - Budget constraints restrict data collection

  - Time constraints restrict data collection

  - Results from data collection are needed quickly

Key concepts*:*

o *Element:* is an object on which a measurement is taken.

o *Population:* is a group of individuals persons, objects, or items from which samples are taken for measurement

o *Sampling units:* are non-overlapping collections of elements from the population that cover the entire population.

o *Sampling frame:* is a list of sampling units.

- subset of the population

o *Sample*: is a collection of sampling units drawn from a sampling frame.

o *Parameter*: numerical characteristic of a population

o *Statistic*: numerical characteristic of a sample

Characteristics of a good sample design

➢ Sample design must result in a truly representative sample.

➢ Sample design must be such which results in a small sampling error.

➢ Sample design must be feasible in the context of funds available for the research study.

➢ Sample design must be such that systematic bias can be controlled in a better way.

➢ Sample should be such that the results of the sample study can be applied, in general, for the population with a reasonable level of confidence.

Sampling Methods

❑ In general there are two sampling methods.

➢ ***Probability Sampling*** – Every element in the population under study has a non-zero probability of selection to a sample

- Every member of the population has an equal probability of being selected

- Includes *Simple Random Sampling, Systematic Sampling, stratified sampling, Cluster Sampling, Multistage Area Sampling, Internet Sampling,* etc.

➢ ***Non-Probability Sampling*** – An *arbitrary means of selecting* sampling units based on subjective considerations, such as *personal judgment* or *convenienc*e.

- It is less preferred to probability sampling

- Include *Convenience Sampling, Purposive Sampling, Quota Sampling, Snowball Sampling,* etc.

Classification of Sampling Methods

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                    Sampling Methods

        Nonprobability            Probability
       Sampling Methods         Sampling Methods

  Convenience   Judgmental   Quota      Snowball
   Sampling      Sampling   Sampling    Sampling

  Simple Random  Systematic  Stratified  Cluster   Other Sampling
    Sampling      Sampling   Sampling   Sampling      Methods
```
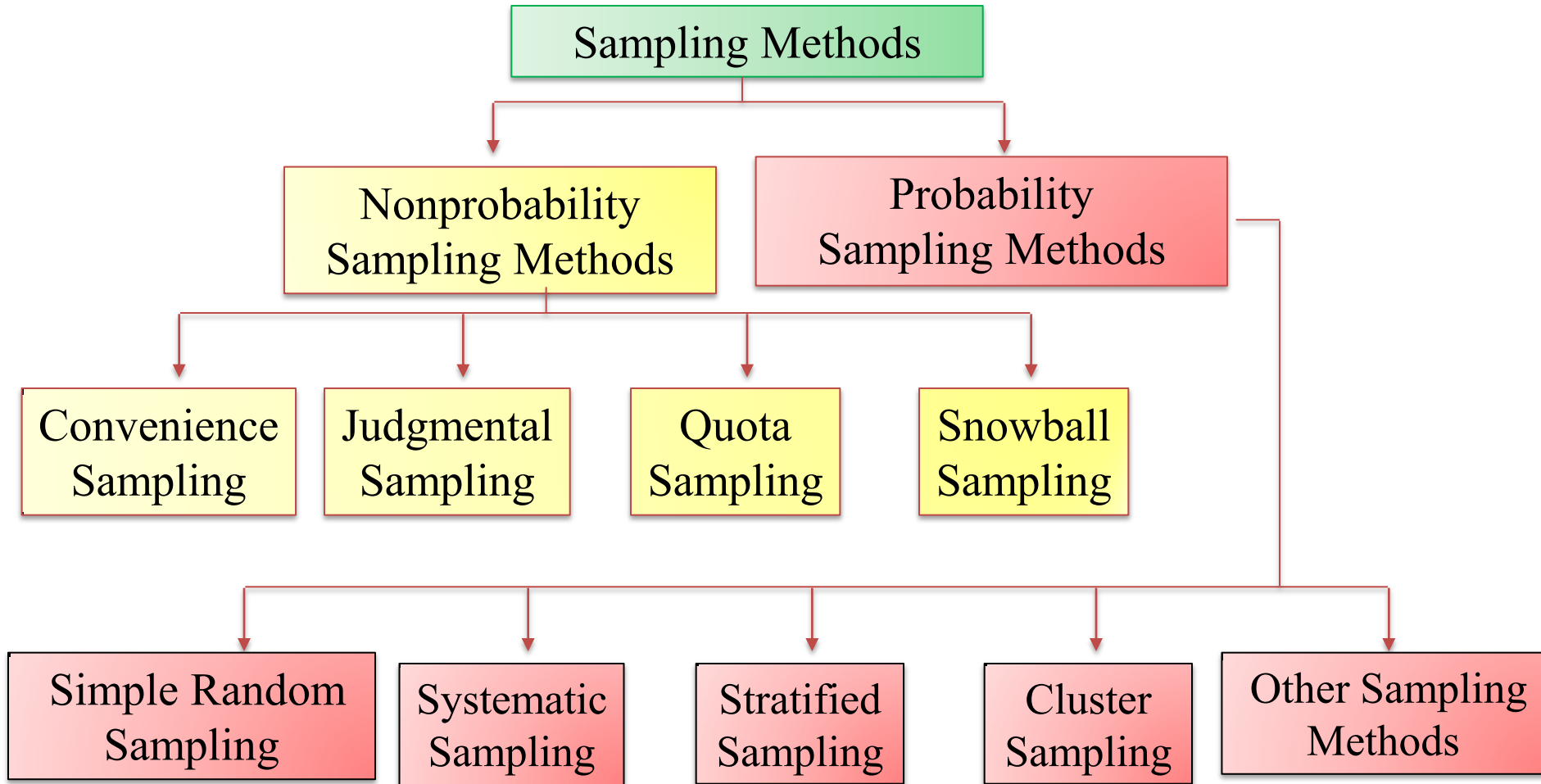
Simple Random Sampling

- Simple Random Sampling: Each member of the population has an equal and known(non-zero) chance of being selected.

  - As the name suggests, is a completely random method of selecting the sample.

    Example: random-digit telephone dialing

- Simple random sampling is the most widely-used probability sampling method, probably because

  - it is easy to implement and easy to analyze.

- Simple random sampling can be further classified into two categories:

  1) *Sampling with replacement*: a population element can be chosen more than once.

  2) *Sampling without replacement*: a population element can be chosen only one time.

Advantage:

- It is the best technique and unbiased method

- It is the best process of selecting representative sample.

- Highly representative if all subjects participate

Disadvantage:

- Not possible without complete list of population

- Potentially uneconomical to achieve

Systematic Sampling

- In Systematic sampling, *every nth element* is selected from a list of population having serial number.

  - Select every kth item on the list (k=N/n, where N=Population size, n=Sample size)

- As long as the list does not contain any hidden order, this sampling method is as good as the random sampling method.

- Once the starting number is decided and collected data it cannot be changed or switched over the other category as per its definition (systemic).

Systematic Sampling

Advantages:

- The systematic sampling design is simple and convenient to adopt.

- Spreads the sample more evenly over the population.

- The time and work involved in sampling by this method are relatively less.

Disadvantages:

- The main limitation of the method is that it becomes less representative if we are dealing with populations having "hidden periodicities".

- If the population is order in a systematic way with respect to the characteristics the investigator is interested in, then it is possible that only certain types of item will be included in the population, or at least more of certain types than others

  – Leads to less representativeness

Stratified Sampling

A two-step process :

- The population is partitioned into subpopulations, or strata.

    - The strata are formed based on members shared attributes or characteristics.

    - Every population element should be assigned to one and only one stratum and no population elements should be omitted

    - The elements within a stratum should be as homogeneous as possible, but the elements in different strata should be as heterogeneous as possible.

- Elements are selected from each stratum by a random procedure, usually simple random sampling.

- Stratified random sampling can be further classified into:

    1. *Proportionate stratified sampling*: where each stratum has same sampling fraction

    2. *Disproportionate stratified sampling*: where each stratum has different sampling fractions

- The following three questions are highly relevant in the context of stratified sampling:

  1) How to form strata?

     - on the basis of common characteristic(s) of the items to be put in each stratum.

  2) How should items be selected from each stratum?

     - simple random sampling/ Systematic sampling

  3) How many items be selected from each stratum or how to allocate the sample size of each stratum?

     - proportional./disproportional allocation

Advantage:

- Give more representative samples and less random sampling error

Disadvantage:

- More complex and information on the strata may be difficult to obtain
- Not useful when the population cannot be exhaustively partitioned into disjoint subgroups.

Cluster Sampling

- Cluster sampling is where the whole population is divided into clusters or groups(usually along geographic boundaries)

- Subsequently, a random sample is taken from these clusters, all of which are used in the final sample

- Elements within a cluster should be as heterogeneous as possible, but clusters themselves should be as homogeneous as possible

- All the other probabilistic sampling methods require sampling frames of all the sampling units, but cluster sampling does not require that.
  - Once the clusters are selected, they are compiled into frames

- Cluster sampling, no doubt, *reduces cost* by concentrating surveys in selected clusters.
  - But certainly it is *less precise* than random sampling.

Non-Probability Sampling: Convenience Sampling

- This is a sampling technique which selects those sampling units most conveniently available at a certain point in, or over a period, of time

- Convenience sampling attempts to obtain a sample of convenient elements.

  - Often, respondents are selected because they happen to be *in the right place at the right time.*

  - Researchers simply use participants who are available at the moment.

- Convenience samples are useful for certain purposes, and they require very little planning.

- Convenience sampling is best used for the purpose of exploratory research

Advantage: it is *quick, inexpensive, and convenient.*

Disadvantage: sample *may not be representative*

Quota Sampling

- In quota sampling, as the name indicates, sampling is done as per the fixed quota

- Within the quota, the selection of sample items depends on personal judgment

- Quota sampling and stratified random sampling are similar in as much as in both methods the universe is divided into parts and the total sample is allocated among the parts.

  - In stratified random sampling, the sample with each stratum is chosen at random.

  - In quota sampling, the sampling within each cell is not done at random

Advantages:

  - Includes the speed of data collection, less cost, the element of convenience, and representativeness (if the subgroups in the sample are selected properly)

Disadvantages:

  - Include the element of subjectivity (convenience sampling rather than probability-based which leads to improper selection of sampling units)

Snowball Sampling

- In snowball sampling, an initial group of respondents (individuals or organizations) are selected, usually at random by probability methods.
  - After the necessary information is being gathered from initial respondents, they are asked to identify additional respondents who belong to the target population of interest.
  - Subsequent respondents are selected based on the referrals.
- Snowball sampling is especially useful when you are trying to reach populations that are inaccessible or difficult to find, for example, in the case of identifying injecting drug users.

Advantage:

- Smaller sample sizes and costs are necessary

Disadvantage

- Second group of respondents suggested by the first group may be very similar and not representative of the population with that characteristic

Measurement scales

- Measurement is a device or a process by which we measure things, objects or properties.

- Measurement is the assignment of numbers to objects

- Scaling describes the procedures of assigning numbers to various degrees of opinion, attitude and other concepts.

- There are four types of scales that are used in measurement:

  - Nominal

  - Ordinal

  - Interval and

  - Ratio scales

- They are categorized into two groups:

  - Categorical scale data: nominal and ordinal scales

  - Continuous scale data: interval and ratio

Cont.

- **Nominal Scales**: A scale which assigns numerals to objects in order to distinguish from each other. However, they have no numerical meanings.

  - They can not be added or ranked

  - No mathematical operation except counting can be done on the data

  - Used for classifying whether the individual items belong to some distinctively different categories.

    E.g. Gender, Race, Color

      Male = 1
      Female = 2

- **Ordinal Scale**: A scale which assigns numerals to objects not only in order to distinguish from each other but also to rank them in a certain order according their characteristics

  - Only certain mathematical variables such as greater than or less than are feasible and only measures such as median and range can be calculated

  E.g. ranking, rating assigned to the impact of a program; like excellent, average and poor.

- **Interval Scales**: A scale which includes all the properties of nominal and ordinal scales and assigns each measurement to a number of categories of equally spaced

  – Not only allows us to rank the measured items but can also help in quantifying the size of the difference between them

  – E.g. temperature, as measured in degrees Fahrenheit or Celsius, constitutes an interval scale.

- **Ratio Scales**: A scale which has all the properties of nominal, ordinal and interval scales and has a unique zero point

  – E.g. weights, lengths and times

Criteria for Good Measurements

Reliability and Validity

- Reliability signifies the issue of consistency of measures

  - The ability of a measurement instrument to measure the same thing each time it is used.

- Validity tries to assess whether a measure of a concept really measures that concept

  - The extent to which the concept measures the thing it was designed to measure.

- A scale of measurement is said to be reliable when a particular characteristic of objects is measured many times and the result obtained in each time is the same

- A scale is said to be valid when it correctly measures what it is expected to measure.

Precision and Accuracy

- Precision signifies perfection in an instrument and assesses how finely an estimate is specified

- Accuracy refers to how close an estimate is to the true value.

- Precision relates to the quality of a process through which a result is obtained, while accuracy relates to the quality of the result.

Designing Research Tools/Instruments

▪ Designing research instruments depends on various factors such as the research problem, type of survey design and nature of information that needs to be collected.

Data Collection

▪ Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.

▪ Data collection is one of the most important stages in conducting a research.

▪ Data collection starts with determining what kind of data required followed by the selection of a sample from a certain population.

– After that, you need to use a certain instrument to collect the data from the selected sample.

Types of data

❑ Data are organized into two broad categories: qualitative and quantitative.

▪ *Qualitative Data*: Qualitative data are mostly non-numerical and usually descriptive or nominal in nature.

- Expressed in words and analyzed through interpretations and categorizations.

▪ *Quantitative Data*: Quantitative data is numerical in nature and can be mathematically computed

  ▪ Expressed in numbers and graphs and is analyzed through statistical methods.

▪ Experimental research is primarily a quantitative method.

▪ Interviews, focus groups, and ethnographies are qualitative methods.

▪ Surveys, observations, archival research and secondary data collection can be quantitative or qualitative methods.

Cont.

❑ Data can also be classified into two based upon who collected the data.

Primary Data: Data that has been collected from first-hand-experience

- Primary data has not been published yet and is more reliable, authentic and objective.

- Primary data has not been changed or altered by human beings; therefore its validity is greater than secondary data.

▪ In primary data collection, you collect the data yourself using qualitative and quantitative methods.

▪ There are many methods of collecting primary data

  ✓ **Questionnaires**: are a list of questions either open-ended or close-ended for which the respondents give answers.

✓ **Interviews**: is a face-to-face conversation with the respondent.

✓ **Focus Group**: is an in-depth field method that brings together a small homogeneous group (usually six to twelve persons) to discuss topics on a study agenda.

✓ **Observation**: involves seeing things such as objects, processes, relationships, events and formally recording the information.

✓ **Survey**: often used to assess thoughts, opinions, and feelings.

✓ **Case-studies**: are in-depth investigations of a single person, group, event or community.

✓ **Experimental Method**: Experiments require an artificial or natural setting in which to perform logical study to collect data.

Secondary Data

- Data collected from a source that has already been published in any form

  - The review of literature in any research is based on secondary data.

  - It is collected by someone else for some other purpose

- Sources of Secondary Data: The following are some ways of collecting secondary data –

  – *Books, Records, Biographies, Newspapers, Published censuses or other statistical data, Data archives, Internet articles, Research articles by other researchers (journals),Databases, etc.*

Methods of Data Analysis

❑ Statistical methods can be classified into two broad categories:

▪ ***Descriptive statistics***: are used to describe, summarize, or explain a given set of data

   ▪ Histograms, Scatter plots…

   ▪ Measures of Central Tendency. Measures of Dispersion. Measures of Association

▪ ***Inferential statistics***: use statistics computed from a sample to infer about the population concerned by making inferences from the samples about the populations from which they have been drawn.

▪ *Inferential statistics tools:*

   ▪ Hypothesis tests,

   ▪ Confidence intervals, and

   ▪ Regression analysis.

Data Preparation

- Data preparation includes editing, coding, and data entry and is the activity that ensures the accuracy of the data and their conversion from raw form to reduced and classified forms that are more appropriate for analysis.

- Data can be presented in one of the three ways: as *text*, in *tabular form* or *in graphical form*

Editing

- Editing detects errors and omissions, corrects them when possible, and certifies that maximum data quality standards are achieved.

- Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as completed as possible and have been well arranged to facilitate coding and tabulation.

Coding

- Coding involves assigning numbers or other symbols to answers so that the responses can be grouped into a limited number of categories.

- In coding, categories are the partitions of a data set of a given variable (e.g., if the variable is gender, the partitions are male and female)

- *Categorization* is the process of using rules to partition a body of data.

- Both closed- and open-response questions must be coded.

Data Entry

- Data entry converts information gathered by secondary or primary methods to a medium for viewing and manipulation.

  – Keyboarding, Optical Recognition, Voice Recognition…

Hypothesis Testing

Hypothesis Testing

- Hypothesis testing is the act of testing a hypothesis or a supposition in relation to a statistical parameter.

Types of Hypotheses:

Alternative Hypothesis:

- Alternative Hypothesis (H1) or the research hypothesis states that there is a relationship between two variables (where one variable affects the other).

Null Hypothesis

- The Null Hypothesis (H0) aims to nullify the alternative hypothesis by implying that there exists no relation between two variables in statistics.
  - **H_0:** On average, men are not taller than women.
  - **H_a:** On average, men are taller than women.
- Hypothesis testing tools: T-test, Chi-Square Test, Z-test…

- **The level of significance**: is the maximum value of the probability of rejecting H0 when it is true and is usually determined in advance before testing the hypothesis.

  - It is always some percentage (usually 5%) which should be chosen with great care, thought and reason.

  - In a hypothesis test, the significance level, is the probability of making the wrong decision when the null hypothesis is true.

Types of Error

In the context of testing of hypotheses, there are basically two types of errors we can make.

- **Type I error:** rejecting the null hypothesis when in fact it is true.

- **Type II error :** not rejecting the null hypothesis when in fact it is false.

  - .

Research Report

- A research report is a well-crafted document that outlines the processes, data, and findings of a systematic investigation.

- Research report can be considered as a summary of the research process that clearly highlights findings, recommendations, and other important details.

- Research reports are recorded data prepared by researchers or statisticians after analyzing information gathered by conducting organized research

- The purpose of writing a research report is to communicate your ideas to the research community

Components of a research report

A research report components:

1. **Abstract or Summary**: The abstract or summary tells the reader very briefly what the main points and findings of the paper are.

2. **Introduction**: statement of the problem, hypotheses, why it is important, objectives of the work, scope of the work

3. **Review of Literature**: discuss related work and indicate how it relates to report

4. **Methods**: describe the method used in project, data used, and how it was obtained

5. **Results**: indicate what happened and interpret what it means

6. **Conclusions and Discussion**: summarize conclusions and what they mean (i.e., answer the question, "So what?"). What changes and further work do you recommend?

7. **References:** to give the reader information about sources cited in the text. Each reference must be described in detail at the end of the article.

Ethics in Research

- Ethics are norms or standards of behavior that guide moral choices about our behavior and our relationships with others.

- The goal of ethics in research is to ensure that no one is harmed or suffers adverse consequences from research activities.

- Unethical activities are pervasive and include:

    - Violating nondisclosure agreements

    - Breaking participant confidentiality

    - Misrepresenting results

    - Deceiving people

    - Avoiding legal liability, and more.

Research Misconduct

- Research misconduct is defined as fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.

- **Fabrication**: reporting of non-existent data
  - making up results and recording or reporting them.
  - Fabricating data is literally making up data. Perhaps it is mentioning an event that did not occur or reports a data that was not used.

- **Falsification**: selective reporting of data or result
  - Modifying results or invent results or misreport
  - Distorting opposing views
  - Reporting misleading facts associated with a study, research or experimentation.

Cont.

- **Plagiarism**: copying without credit or claiming credit for results of others
  - Copying another person's ideas, processes, or results without giving appropriate credit.
  - Intentionally take a passage word-for-word, put it in their own work, and do not properly credit the original author
- **Suppression**: not reporting negative results
  - The failure to publish significant findings due to the results being adverse to the interests of the researcher or his/her sponsor(s)
  - Hiding objections that cannot be refuted or destroying or concealing sources and data important for those who follow

Some Ethical Principles

Some ethical principles many codes addresses:

- *Honesty* – in reporting data, results, methods, procedures. No fabrication, falsification, etc.

- *Objectivity* – strive to avoid bias in experimental design, data analysis, etc.

- *Integrity* – keeping promises and agreements

- *Carefulness* – avoid carless errors and negligence; critically examine your work, etc.

- *Openness* – share data, results, ideas, etc. And be open to criticism.

- *Respect for intellectual property* – honor patents, copyrights, etc. No use of unpublished data without permission. Give credit when credit is due.

- *Confidentiality* – protect confidential communications such as paper submitted for publication, etc.

- *Legality* – know and obey relevant laws institutional and government policies

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THANK YOU!