Research Methodology

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Outlines

- What is Research?
- Research Objective.
- Scope of Research.
- Research Process.
- Research Types.
- Research Limitations.

Unit-I

- Sampling Design Techniques.
- Data Collection.
  - Primary Data
  - Secondary Data
- Designing Questionnaire.
- Data Preparation.

Unit-II

What is Research?

- "The definition of research includes any gathering of data, information and facts for the advancement of knowledge"- Martyn Shuttleworth

- "Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". -Creswell

- "A studious inquiry or examination; especially: investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws"

  - Merriam-Webster Online Dictionary.

Research Objectives

- It should reflect the aspirations and expectations of the research topic.
- To gain familiarity with a phenomenon or to achieve new insights into it.
- To portray accurately the characteristics of a particular individual, situation or groups.
- Hypothesis testing for the casual relationship between variables.
- Emphasize how aims are to be accomplished and must be highly focused and feasible.
- Objectives should be address the more immediate project outcomes and make accurate use of concepts which to be sensible and precisely described.

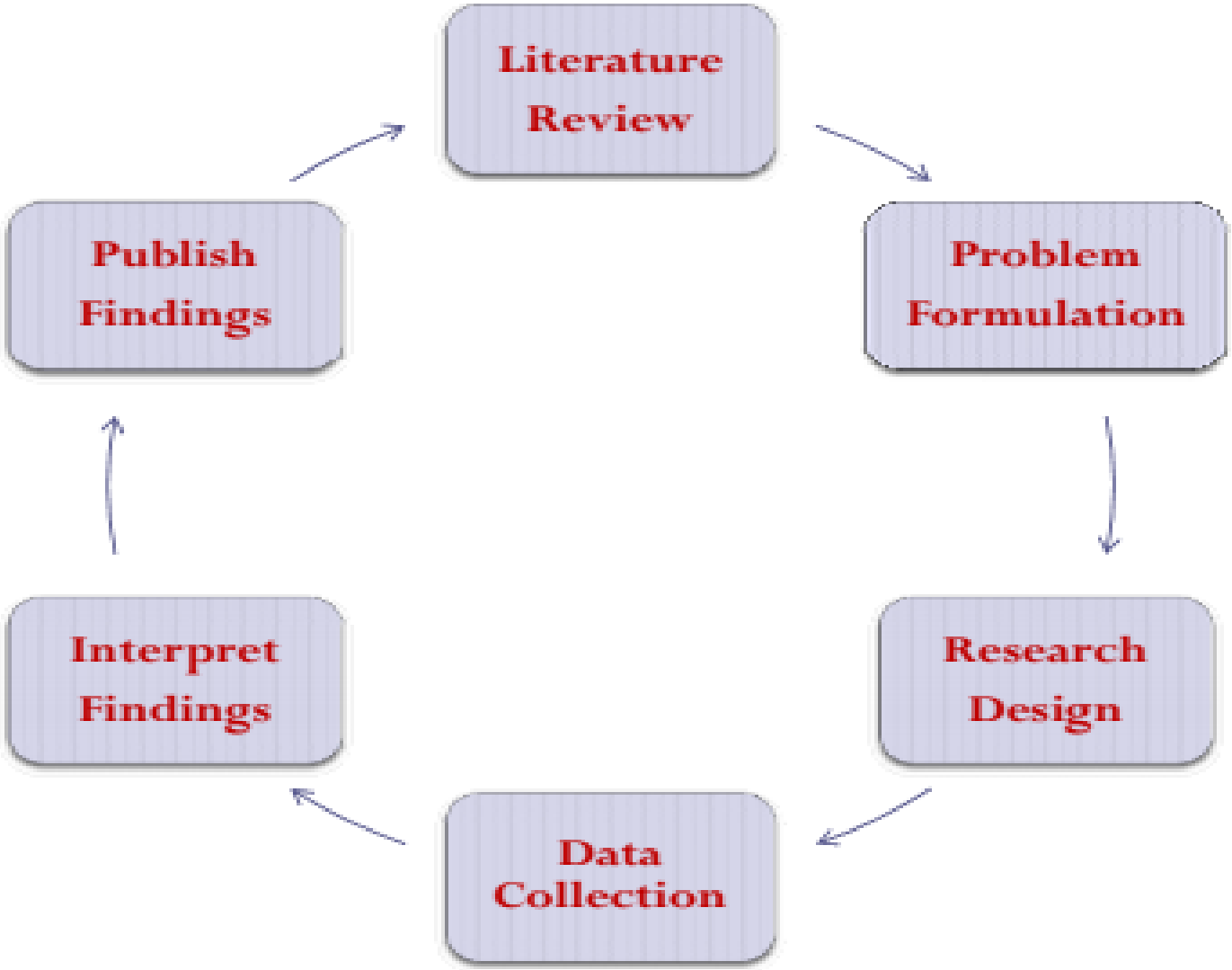
Why People does Research?

- The motivation behind research may have following reasons-
  - Interested to face the challenge in solving the unsolved problems.
  - To get intellectual joy of doing some creative work.
  - Desire to be service to society.
  - Curiosity about new phenomenon or thing.
  - Concerned about social thinking.
  - Desire to get a research degree along with its **consequential benefits** etc.

Scope of Research

- For Ph.D. students, the contribution expected at world level- e.g.
  - Background investigation on all past work.
  - Make meaningful addition to world knowledge.
  - Expect new innovation and findings.

Research Process



Research Process..*contd*

- Initial idea or Concept.
- Background investigation and review related work.
- Refinement of idea.
- Core Work-
  - Investigation and Development.
  - Documentation.
  - Prototype (if applicable).
- Evaluation.
- Identification of Future Work.
- Report, Publication and Presentation.

Research Types

- **Descriptive vs. Analytical**: **In Descriptive research** includes surveys and fact findings enquiries of different kinds.

  In Analytical Research, the researcher has to use or analyze facts or information already available.

- **Applied vs. Fundamental**: **In Applied (Action) Research** aims to findings to a solution of immediate problem.

  On the other hand in **Fundamental (pure) Research** mainly concerned about formulation of basics facts.

- **Quantitative vs. Qualitative**: **Quantitative Research** is based on the measurements of quantity or amount.

  Quantitative Research is relate with quality or kind.

Quantitative vs. Qualitative Research

Quantitative Research Strategy

- Investigation aims to assess a pre-stated theory (Deductive).
- Often involves hypothesis testing.
- Attempts to minimise the influence of the researcher on the outcome.
- Quantitative data infers statistics.
- Data collection requires **closed** responses.

Qualitative Research Strategy

- Investigation aims to create a novel theory (Inductive Reasoning)
- *Ethnography:* Researcher becomes an inherent part of the study.
- Qualitative data infers complex statements or opinions.
- Data collection therefore permits **open** responses

Research Types...*contd*

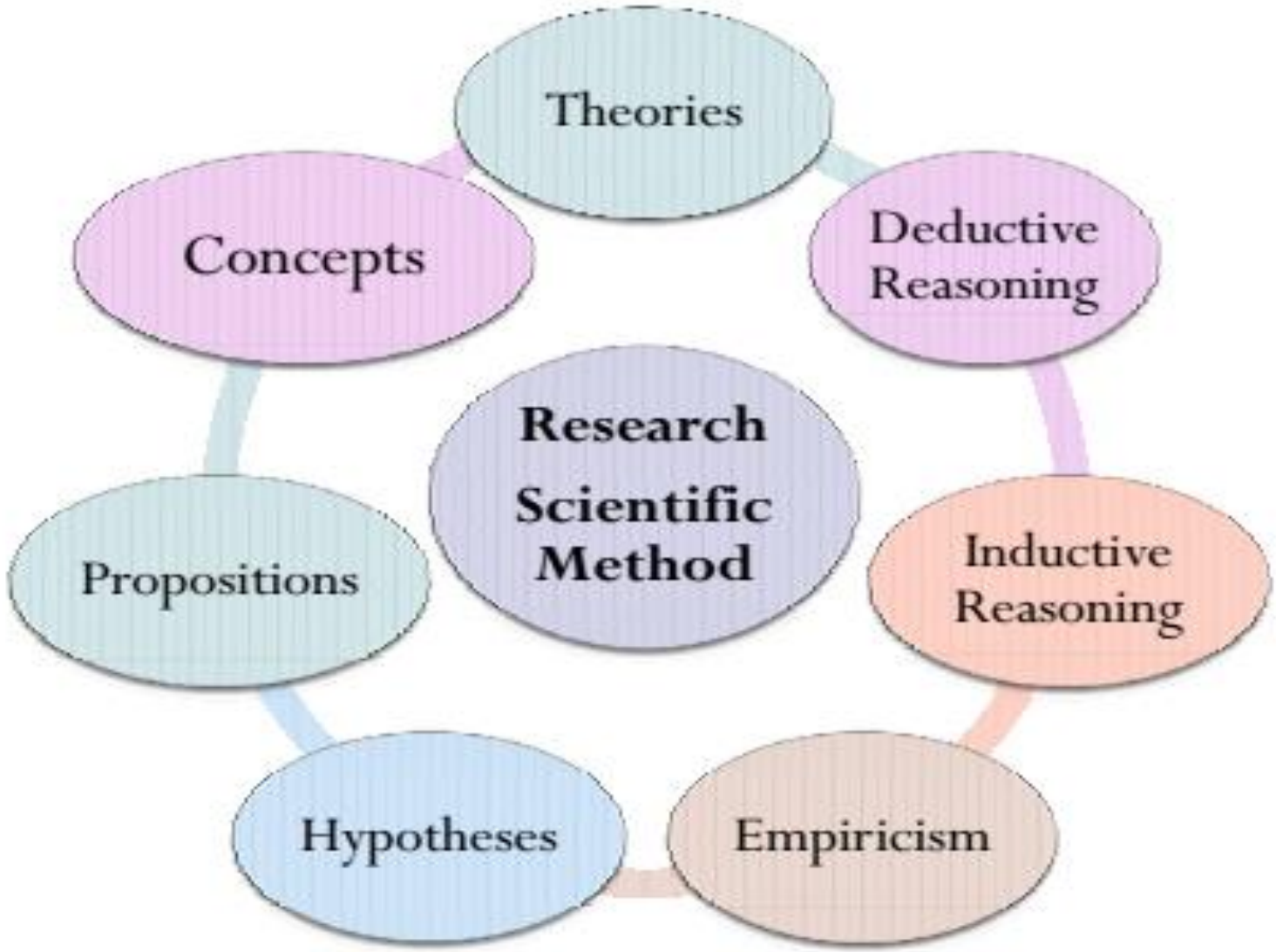
- **Conceptual vs. Empirical**: **Conceptual Research** is related with some idea or theory based on philosophy or thinking to develop new concepts or reinterpret the existing one.

  In **Empirical Research** based on experience and observation alone without due regard for system and theory.

- **Some Other Types of Research**:
  - **One Time Research vs. longitudinal research.**
  - **Field Setting vs. Laboratory Research**

    (Simulation Research is Laboratory Research)
  - **Conclusion Oriented or Decision oriented.**

Dimensions of Research



Scientific Method in Research

- The characteristics of the scientific method may have following characteristics elements:
  - **Empirical approach.**
  - **Observations.**
  - **Questions.**
  - **Hypotheses.**
  - **Experiments.**
  - **Analyses.**
  - **Conclusions.**
  - **Replication-** Repeating Same Work to re-check result.

Research Limitations

- Data is sometimes not available or accessing data is very difficult.
- Some case difficult to understand context of a phenomenon, difficult to analyze and don't fit neatly in standard categories.
- Data may not be robust enough to explain complex issues.
- Findings usually cannot be generalized to the study population or observation categories.
- Some case shortage of manpower and finance is also a major issue, if researcher project is not financial granted by some organization.
- In few case, the data collection is so rigorous and time consuming.

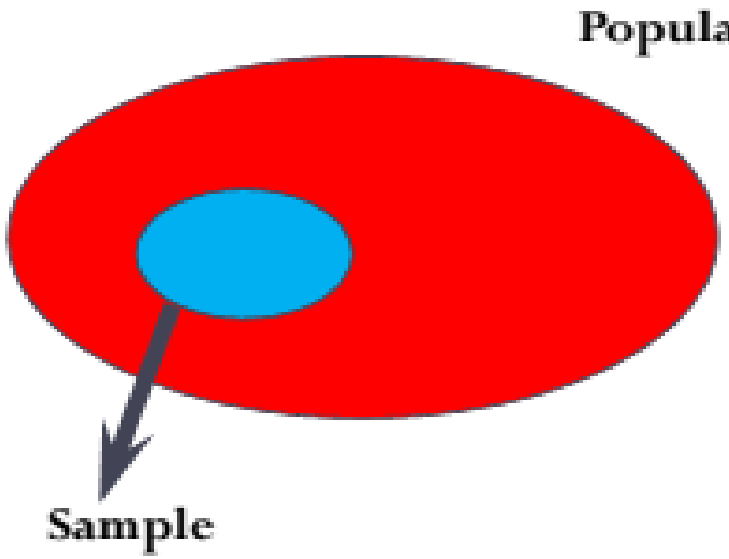
Unit-II-Part-I

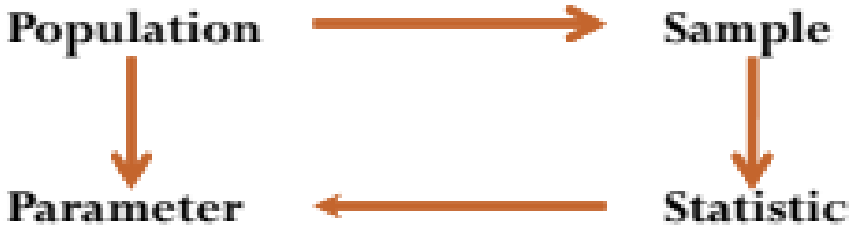
Sampling Design Techniques

What is Sampling and Why?

- The process of selecting a number of individuals for a study in such a way that the individuals represent the larger group from which they were selected.
- The process of obtaining information from a subset (sample) of a larger group (population).
- To gather data about the population in order to make an conclusion that can be generalized to the population.
- Sampling can save time and money.

Population Vs. Sample



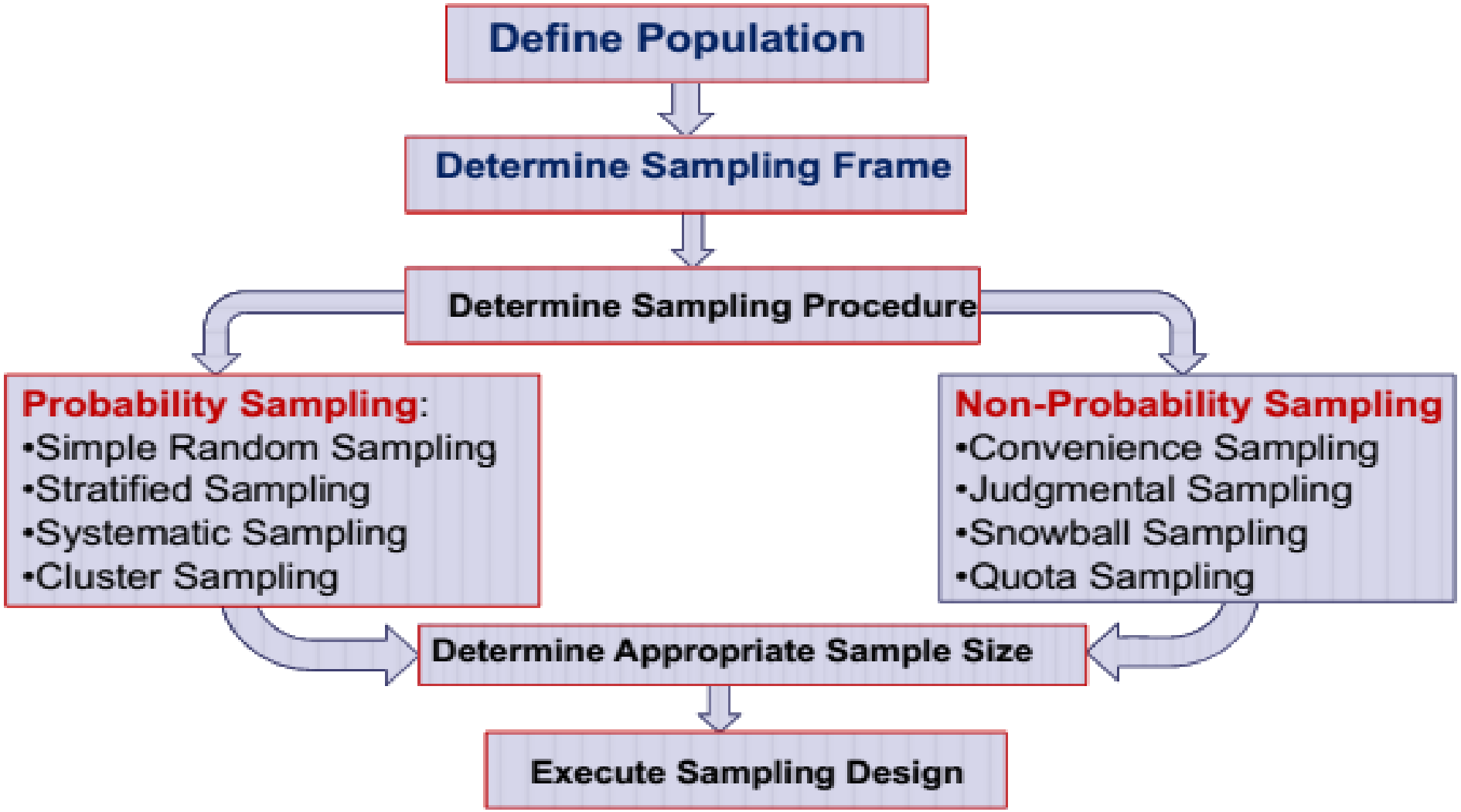


- We measure the sample using statistics in order to draw inferences about the population and its parameters.

Sampling Terminologies

- **Population**: Data set of interest from the researcher needs to obtain information. One unit from a population called **Element**.
- **Sampling Frame**: Listing of population from which a sample is chosen.
- **Census and Survey**: A polling of the entire population, but survey means a polling of the sample. **Parameter**: The variable of interest.
- **Statistics**: The information obtained from the sample about the parameter.
- **Critical Assumption** : The sample chosen is representative of the population.

Sampling Design Process



Goal of Sampling Process and Issues

- To be able to make **inferences** about the population parameter from knowledge of the relevant statistic to draw general conclusions about the entire population.

- **Two Important factors during Sampling Design–**
  - **Select the right data**: Have to be selected scientifically so that data representative of the entire population.
  - **Select the adequate number of the right data**: To minimize sampling errors that means choosing the wrong data by chance.

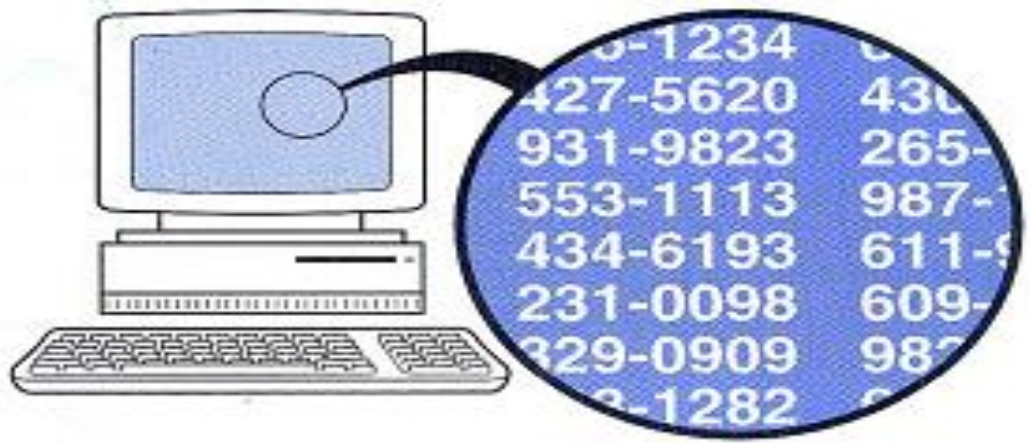
- **Sampling Error**: Frame Error + Chance Error + Response Error.

Sampling Procedure

- **Probability sampling : Equal chance of being included in the sample (random).**
  - Simple random sampling
  - Systematic sampling
  - Stratified sampling
  - Cluster sampling
- **Non-probability sampling: Unequal chance of being included in the sample (non-random).**
  - Convenience sampling
  - Judgment sampling
  - Snowball sampling
  - Quota sampling

Simple Random Sampling

- An objective procedure in which the probability of selection is non zero and is known in advance for each population unit.
- Ensures information is obtained from a representative sample.
- Population members are selected directly from the sampling frame.
- Equal probability of selection for every sample (sample/population size)
- Normally Use random number table or random number generator.



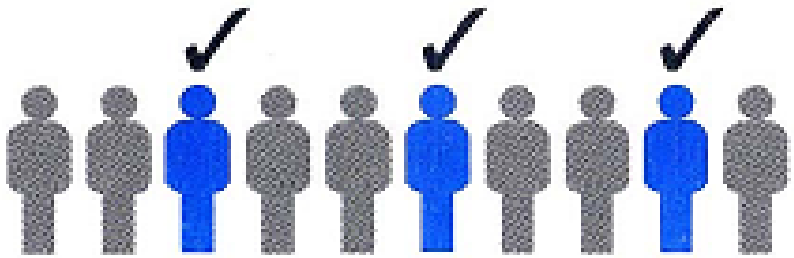
Systematic Sampling

- **Systematic sampling** involves a random start and then proceeds with the selection of every *k*th element from then onwards.

  Here *k*=(population size/sample size).

- It is important that the starting point is not automatically the first in the list, but is instead randomly chosen from within the first to the *k*th element in the list.

- Order all units in the sampling frame based on some variable and number them from 1 to *N*



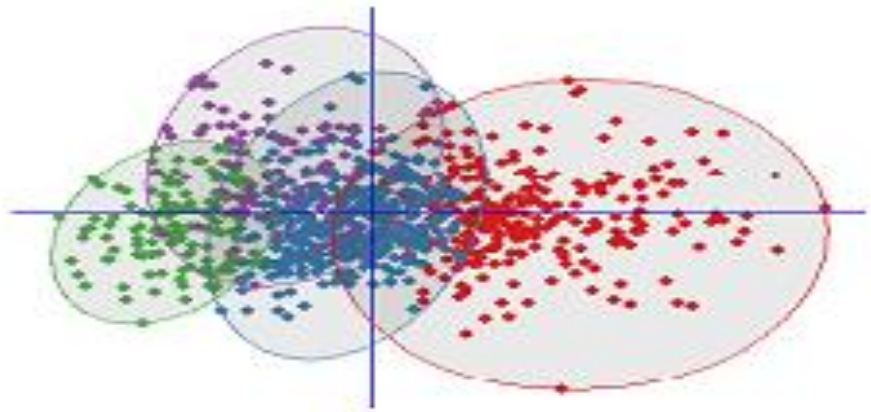
Stratified Sampling

- The chosen **sample is forced to contain units** from each of the segments or strata of the population. Its Equalizing "important" variables.
- Population is divided into **mutually exclusive and exhaustive strata** based on an appropriate population characteristic. (e.g. time, SNR, Frequencies etc.)
- Minimize the sampling error since a source of variation is eliminated.

Cluster Sampling

- The chosen **sample is forced to contain units** from each of the segments or strata of the population. Its Equalizing "important" variables.
- Population is divided into **mutually exclusive and exhaustive strata** based on an appropriate population characteristic.

  (e.g. power level, SNR, Frequencies etc.)



- Divide the cluster based on parameters, whose information sought for.

Sampling Design..choose smart way for best result and minimize cost.

- **When to use Stratified Sampling-**
  - If primary research objective is to compare of various groups.
  - Using stratified sampling may reduce sampling errors.

- **When to use Cluster Sampling-**
  - If there are substantial fixed costs associated with each data collection.
  - When there is a list of clusters but not of individual population members.

Non-Probability Sampling

- Subjective procedure in which the **probability of selection** for some population units are zero or unknown before drawing the sample.
- Information is obtained from a **non-representative sample** of the population.
- **Sampling error can not be computed.**
- Survey results cannot be projected to the population.
- **Advantages:**
  - **Cheaper and faster** than probability.
  - Reasonably **representative** if collection in proper way.

Types of Non-Probability Sampling

- **Convenience Sampling**: The process of including whoever happens to be available at the time, also called "accidental" or "haphazard" sampling.

- **Judgment Sampling**: A researcher exerts some effort in selecting a sample that seems to be most appropriate for the study.

- **Snowball Sampling**: Selection of additional respondents is based on referrals from the initial respondents and used to sample from low incidence or rare populations.

- **Quota Sampling**: The population is divided into cells on the basis of relevant control characteristics.
  - A quota of sample units is established for each cell.
  - A convenience sample is drawn for each cell until the quota is met.

Probability Vs. Non-Probability Sampling

- **Non-probability** sampling is less time consuming and less expensive.

- The probability of selecting one element over another is not known and therefore the estimates cannot be projected to the population with any specified level of confidence. **Quantitative generalizations about population can only be done under probability sampling.**

- However, marketing researchers also apply statistics to study non-probability samples.

Sampling Errors

- Random Error : The sample selected is not representative of the population due to **chance**.
- The level of it is controlled by sample size.
- A **larger sample size** leads to a smaller sampling error.

Non-Sampling Errors

• A response or data error is any **systematic bias** that occurs during data collection or in data analysis or interpretation is considered a non sampling error. e.g.

- Respondent error.
- Interviewer bias.
- Recording errors.
- Poorly designed questionnaires.

Data For Research

- Data Collection begins after the **Research Problem Defined** and **Research Design** carried out.
- There are two types of Data-
- **Primary Data**: Original Data which are taken for the first time.
- **Secondary Data**: Those are already been collected by someone else and which have already been passed through the statistical process.
- The procedure for data collection for primary and secondary data are different.
- Type Research as per Data Collection-**Experimental Research**-performing experiment for data collection and **Descriptive Type Research** doing surveys and others.

Primary Data Collection

- There are several methods for collection the primary data-(For Surveys and descriptive research)
- **Observation Method:**
  - Specially used for studies relating to behavioral sciences.
  - Advantage is subject bias is eliminated.
  - This method is independent of Respondents.
  - Limitation: It is very expensive and some times unforeseen factors may interfere with the observation leads to error.
- **Interview Method:**
  - Collection of data involves presentation of oral verbal responses.
  - Personal Interview: Personal interview is usually carried out in a structured way.
  - There should be clear formulation for pre-requisites and basic tenets of interviewing.
  - Telephonic Interview: More Flexible
  - This method also have some demerits.

Primary Data Collection..contd

- **Through Questionnaire:**
  - A questionnaire consists of numbers of question printed or typed on a forms.
  - Also collection the data by mailing the questionnaire to respondents.
  - There is low cost to implement the process and easily send to any respondents across the globe.
  - Respondents have adequate time to give well thought out answers.
  - Limitation: Slow process, low rate of return of duly filled of questionnaires and it is only used if respondents are educated and co-operating.
- **Through Schedules:**
  - Similar as Collection of data in questionnaire, but the differences is schedules being filled by enumerators who are specially appointed for this purpose.
  - Schedules are Performa containing a set of questionnaire.
  - Enumerators should be intelligent and must posses the capacity of cross examination in order to find the truth.
  - Useful for extensive enquiries and fairly reliable results.
  - Population census over the world is conducted through this method.

Secondary Data Collection

- Secondary data means data are already available.
- Those data which have already been collected and analyzed.
- Various Publication across the globe
- Technical Journals
- Books, magazine and News papers
- Reports of various association and organization
- Theses and dissertation for scholars
- Public records and statistics.

Secondary Data Collection

- Researcher must careful before using secondary data.
- Researcher must make a scrutiny because it is possible that the secondary data may unsuitable or inadequate in the context related which the researcher wants to study.
- According to **Dr. A.L Bowley** it is never safe to take published statistics at their face value without knowing the meaning and limitations.
- **Before using the Secondary Data, it must posses the following characteristics-**
  - Reliability of Data: Tested by findings out such things about the said data.
  - Suitability of Data: The object, scope and nature of the original enquiry must be studied before using those secondary data.
  - Data Adequacy : Is the level of accuracy is consider for the present findings.

The Appropriate Methods for Data Collection

- **Based on following factors-**
  - Nature, scope and Enquiry: The method will be such that it suits for requirements of researcher.
  - Availability of Funds: It determine to how large extents the method to be used for the data collection. For those developing countries the finance is big constraint and researcher has to act within its limitations.
  - Timing Factor: The time requirements and availability also determine the specific data selection.
  - Precision Required: Precision is yet another important factor to be considered before selection the method of data collection.

Designing Questionnaire

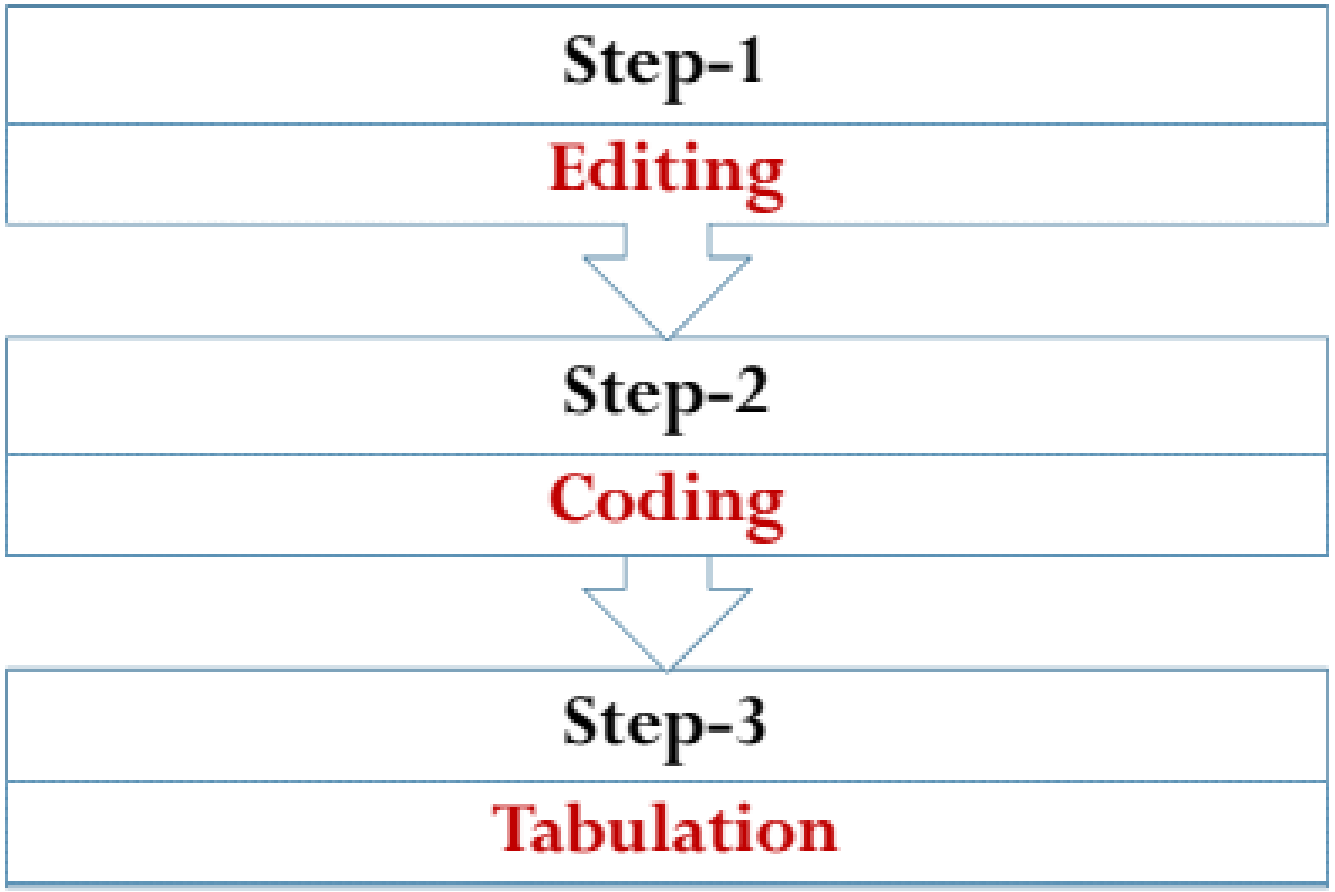
- Researcher must **clear** about the various aspects of his/her research problem to be dealt.
- The pattern of Questionnaire depends on the **nature of information** sought.
- The type of question should be **closed or open up**, decided based on result expected for.
- Questions should be **simple** and must be constructed with a view to their forming a **logical part** of a well thought out tabulations plan.
- Before **finalizing** the questions, rough draft should be prepared.
- **Pilot study** should be undertaken for pre-testing the questionnaire.
- Questionnaire must contain simple but **straight forward directions** for the respondents.

Data Preparation

- Data Preparation **involves checking or logging the data in**; checking the data for **accuracy**; **entering or tabulation** the data into the computer; **transforming the data**; and developing and documenting a database structure that integrates the various measures.

- **Why Data Preparations-**
  - Adequacy Check.
  - Are the responses legible/readable?
  - Are all important questions answered?
  - Are the responses complete and acceptable?
  - Is all relevant contextual information included to my intended findings?

Process of Data Preparations



Editing

- The process of checking and adjusting responses in the completed questionnaires or observation for omissions, legibility, and consistency and readying them for coding and storage.
- **Purpose**:
  - For consistency among responses or observation.
  - For completeness in responses to reduce effects of non-response items.
  - To order the observation or answered and facilitate the coding process.
- **Types**:
  - **Field Editing:** Preliminary editing by a field supervisor on the same day, check legibility of handwriting, and clarify responses that are logically or conceptually inconsistent.
  - **In-house Editing:** Editing performed by a head office; often dome more rigorously than field editing

Coding

- The process of identifying and classifying each answered or observation with a numerical score or other character symbol.
- The numerical score or symbol is called a **code**, and serves as a rule for interpreting, classifying, and recording data
- Identifying responses with codes is necessary if data is to be processed by computer.
- Coded data is often stored electronically in the form of a **data matrix** - a rectangular arrangement of the data into rows (representing cases) and columns (representing variables)
  - **Field:** A collection of characters that represents a single type of data.
  - **Record:** A collection of related fields i.e., fields related to the same case.
  - **File:** A collection of related records, i.e. records related to the same sample.

Tabulation

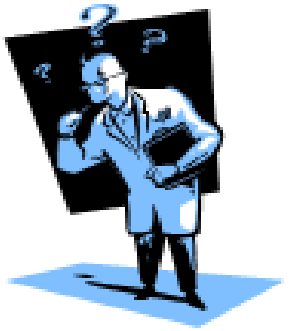
- Tabulation is the final step of Data Preparation.
- It normally counting the number of observation and responses in various data categories.
- For small size, manual tabulation certainly be the best.
- Cross tabulation also a important process for finalizing tabulation process.
- Data Transformation may be the part of tabulation.
- **Data Transformation**: Converting some of the data from the format in which they were entered to a format most suitable for particular statistical analysis.

Conclusions:

- Research is a scientific method to used to collect and analyze information to increase our understanding or solve issue on particular field.
- Research should reflect the aspirations and expectations of the research topic
- It has been understood that **Sampling Design** and **Data Collection** are important part of research design.
- The last part of presentation covered up **Data Preparation** for research, it consists three steps-editing, coding and tabulation.

- After conducting the study or gathering the data, the next step involves **Analyzing the Data**, which generally calls for the use of statistical techniques.
- The type of statistical techniques used by a researcher depends on the **Research Design** and **Type** of data being gathered.

Thank You



Any Questions?