

TYPES OF SAMPLING : PROBABILITY & NON- PROBABILITY

DR. RASHMI GORE

OBJECTIVES OF LECTURE

After this lecture you will be able to:

- Define the term population & Sample.
- Explain the steps involved in the process of sampling.
- Describe methods of sampling : Probability sampling & Non-probability sampling.
- Explain the advantages and limitations of various types of probability sampling.
- Describe the advantages and limitations of various types of Non-probability sampling.

CONCEPT POPULATION & SAMPLE

POPULATION

- A population is any group of individuals that have one or more characteristics in common and that are in interest of researcher. (Best & Kahn, 1995)
- A population refers to any collection of specified group of human beings or of non human entities such as objects, educational institutions, time units, geographical areas, prices of commodities, salary of an individual etc. (L. Kaul, 2010)

SAMPLE

- In research, term sample is **a group of people, objects, or items that are taken from a larger population for measurement.** The sample should be representative of the population to ensure that we can generalize the findings from the research sample to the population as a whole.

STEPS OF SAMPLING PROCESS

- Defining the population.
- Preparing sampling frame,
- Selecting a representative sample through proper sampling method.
- Obtaining an adequate sample.

(The adequacy of sample is depended upon

1. Our knowledge about population.
2. The method used in drawing the sample.)

METHODS OF SAMPLING

There are two broad categories of sampling-

- **Probability sampling** or random sampling.
- **Non- Probability sampling** or non-random sampling.

PROBABILITY SAMPLING

- In probability sampling, a sample has been selected in such a way that **every element chosen has a known probability of being included.**
- Probability sampling means that every member of the target population has a known chance of being included in the sample.

CHARACTERISTICS OF PROBABILITY SAMPLING

- Generally used in Fundamental Researches : **main objective is to generalize the result**
- based on statistical concepts:
 - **Larger sample more precision value of parameter**
 - **Normal distribution**
- Best for **homogeneous population**

TYPES OF PROBABILITY SAMPLING

There are four types of probability sampling :

- **Simple random sampling**
- **Systematic random sampling**
- **Stratified random sampling**
- **Cluster random sampling**

SIMPLE RANDOM SAMPLING

- In **simple random sampling**, each member of the population(**N**) has an equal chance of being selected in the sample (**n**) by randomization.
- This method is also called an equal probability of selection method.

Techniques of randomization

- *Lottery method*
- *Use of table of random numbers*

SIMPLE RANDOM SAMPLING: LOTTERY METHOD

Procedure:

- Define population
- Prepare sampling frame
- Arrange the no. of units without order
- Mix the slips or chits after naming or labelling every unit of the population
- Draw require no. of units from those well mixed chits

SIMPLE RANDOM SAMPLING: LOTTERY METHOD EXAMPLE

- The example in which **the assignment of 25 students out of 250 are chosen** is an example of the lottery method at school. Each of the 250 students would be assigned a number between 1 and 250, after which 25 of those numbers would be chosen at random.

SIMPLE RANDOM SAMPLING: LOTTERY METHOD WITH REPLACEMENT & WITHOUT REPLACEMENT TECHNIQUES

SAMPLING WITH REPLACEMENT

- The technique of sampling is said to be **with replacement** when a sampling unit is drawn from a finite population and after its characteristic(s) have been recorded, is returned to that population, before the next unit is drawn

SAMPLING WITHOUT REPLACEMENT

- whereas **sampling without replacement**, the units once drawn and selected as sample, not be returned to that population.

In order to account for this difference when using the table or generate for random digits, one must ignore the repeated number that was included in the labeling.

ADVANTAGES & LIMITATIONS OF LOTTERY METHOD

- **Advantages –**

- Equal chance of every unit of population to be selected in sample.
- Best for homogeneous population.

- **Limitations –**

- Not possible in a larger/infinite populations.
- Impossible to include specific units of population.

SIMPLE RANDOM SAMPLING: USE OF TABLE OF RANDOM NUMBERS

- For large population simple random method may be used through using computer generated random number programme or random digit table prepared by Kendall & Smith, Tippett, Fisher & Yates etc.
- Save time, money, labour.
- No special technical assistance is needed.

LIMITATIONS OF USING TABLES OF RANDOM NUMBERS

- Can not provide true representative sample in heterogeneous population.
- When the population is infinite, difficult to prepare sample frame.
- Inclusion of specific units of population is not possible.

SYSTEMATIC RANDOM SAMPLING

When -

- population is **finite &** can be accurately listed or availability of **sampling frame**.
- Units of population are alphabetically /merit wise/ etc. **arranged in a systematic manner**.

Systematic sampling, after numbering N units in population from 1 to N is to select a sample of n units by taking a unit at random from the first k unit and every k^{th} thereafter.

SYSTEMATIC RANDOM SAMPLING

- Systematic sampling is a **type of probability sampling method in which sample members from a larger population are selected according to a random starting point but with a fixed, periodic interval.** This interval, called the sampling interval, is calculated by dividing the population size by the desired sample size. - <https://www.investopedia.com>
- When population is **finite & can be accurately listed** or availability of **sampling frame.**

SYSTEMATIC RANDOM SAMPLING: STEPS

1. Define population.
2. Number the units of population from 1 to N.
3. Decide sample size (n).
4. Decide the sampling interval (k) = population size / sample size.
5. Choosing starting point by randomly selecting one number between 1 and k.
6. **After determination of k and starting point the rest units of the sample can be selected** If you have a starting point of 15 and a sample interval of 100, the first member of the sample would be 115, and so forth.

SYSTEMATIC RANDOM SAMPLING: EXAMPLE

- when a principal wants to select 6 teachers out of 60 of their staff for a particular task. He will select after preparing list of all appointed teachers in alphabetical manner and randomly select one, suppose no. **5** is selected randomly. Then he will select **15th, 25th, 35th, 45th & 55th**.

SYSTEMATIC RANDOM SAMPLING: LIMITATIONS

- **Advantages –**

- Simplicity
- Practicality
- Speediness

- **Limitations –**

- Randomly selected first element has influence on the selection of other element.
- Not for heterogeneous & infinite population.

STRATIFIED RANDOM SAMPLING

- When units in a sample are **proportional to its population**, the sample is called stratified.
- In stratified sampling researcher has to divide the population of N units into sub-populations which is called strata like $N_1, N_2, N_3, \dots, N_n$, respectively.
- The sample sizes within the strata are denoted by $n_1, n_2, n_3, \dots, n_n$ respectively.
- The usual stratification factors are gender, age, socio-economic status, educational background, residence (rural/urban), occupation, religion, caste, general intelligence etc.

STRATIFIED RANDOM SAMPLING: STEPS

- Defining the population.
- Deciding the criteria on which population will be formed like male/female/transgender, higher/middle/lower SES, rural/urban/semi urban etc.
- Dividing the population into stratum on the basis of stratification variables.
- Listing the units in each stratum.
- Selecting required no. of units from each strata by using appropriate random selection techniques.

STRATIFIED RANDOM SAMPLING: CLASSIFICATION

There are two types of stratified random sampling :

- **Proportionate stratified random sampling**

Selection of a sample from each sampling unit is in proportion to its size and unit.

- **Disproportionate stratified random sampling**

The selection in which each unit is not proportionate to the size of the units in population but depends upon researcher's judgement and convenience.

EXAMPLE OF PROPORTIONATE & DISPROPORTIONATE STRATIFIED RANDOM SAMPLING

Distribution of students according to their programmes

Students enrolled in programmes	Population	Proportionate Stratified Sampling	Disproportionate Stratified Sampling
B.A.	200	20	25
B.Sc.	100	10	25
B.Com.	400	40	25
B.B.A.	300	30	25
Total	$N_p = 1000$	$n = 100$	$n = 100$

STRATIFIED RANDOM SAMPLING: ADVANTAGES & LIMITATIONS

Advantages –

- when list of units or individuals in population are not available.
- This method is also suitable when cent- percent response is difficult to secure in desired time.
- Stratified random sampling provides more accurate results than simple random sampling if stratifications results are homogeneous within strata.

Limitations –

- Can't use stratified sampling method when population is heterogeneous in nature internally in sub-groups.
- Researchers can't confidently classify every member of the population into a subgroup.

CLUSTER SAMPLING METHOD

- Cluster sampling is a method of probability sampling that is often used to study **large populations**, particularly those that are **widely geographically dispersed**. Researchers usually use pre-existing units such as schools or cities as their clusters.
- In case of **infinite population** or **not reliable list of elements** and **geographically scattered population**, cluster sampling method is used.

CLUSTER SAMPLING OR AREA SAMPLING

- The nature of strata internally is homogeneous in stratified random sampling but in **cluster sampling method, its nature is heterogeneous.**
- In cluster sampling, cluster is selected randomly i.e. a collective type of units like schools, cities etc. not single elements i.e. individual student, teacher etc.

CLUSTER SAMPLING: EXAMPLE

- If a researcher is interested in the average reading level of all the seventh-graders in his state.
- It would be very difficult to obtain a list of all seventh-graders and collect data from a random sample spread across the state. However, he can easily obtain a list of all schools and collect data from a subset of these, thus he decides to use the cluster sampling method.
- To survey the health status of primary school children of a state, researcher selects randomly clusters of units under cluster sampling method.

CLUSTER SAMPLING: ADVANTAGES

- **Time- and cost-efficient** especially for samples that are widely geographically spread and would be difficult to properly sample through other method.
- **High external validity**, because cluster sampling uses randomization, if the population is clustered properly, sample will reflect the characteristics of the larger population.

CLUSTER SAMPLING: LIMITATIONS

- In comparison to simple random sampling **internal validity is less strong.**
- Cluster sampling is much **more complex** to plan than other forms of sampling.

NON - PROBABILITY SAMPLING TECHNIQUES

- When the units of the population are selected at the discretion of the researcher
- Non-probability sampling is a **method of selecting units from a population using a subjective (i.e. non-random) method**. Since non-probability sampling does not require a complete survey frame, it is a **fast, easy and inexpensive way of obtaining data**.
- Non-probability sampling is defined as a **sampling technique in which the researcher selects samples based on the subjective judgment of the researcher rather than random selection**

NON - PROBABILITY SAMPLING TECHNIQUES: TYPES

- **Incidental, accidental or convenient sampling**
- **Purposive or judgemental sampling**
- **Quota sampling**
- **Snow ball or chain sampling**
- *Dense sampling*
- *Double sampling*

INCIDENTAL, ACCIDENTAL OR CONVENIENT SAMPLING

- Accidental or incidental is **that type of sampling in which a researcher pick up data or information's from those who fall into hand or present at the time of research**. It continues the process till the completion of the sample size.
- For instance, **a person who is obtaining opinions for a political poll at a shopping mall by randomly selecting passers-by** is using a form of accidental sampling
- Convenience sampling (also called accidental sampling or grab sampling) is a method of non-probability sampling where **researchers will choose their sample based solely on the convenience**.

WHEN IT IS USED ?

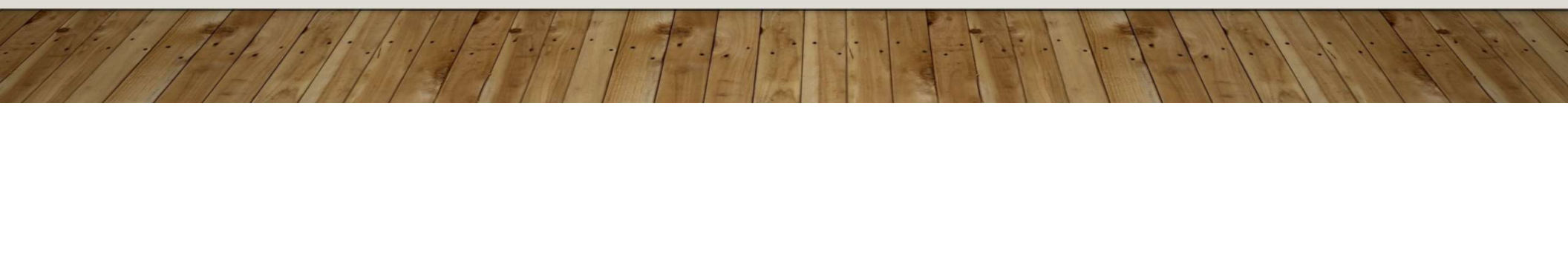
- When researchers are more concerned with the number of responses, and not the actual representativeness of the sample.
- When budgeting is tight and researchers want a low-cost method to collect data.
- When pilot testing.
- When observing habits, opinions, and viewpoints of a target audience.
- When collecting feedback on various brands or organizations.
- When researchers don't have access to the full target population for a representative sample.

ADVANTAGES & LIMITATIONS

Advantages

- Time & cost effective
- Uncomplicated method of data collection

Limitations

- Biasedness of researcher
 - Low external validity
- 

PURPOSIVE OR JUDGEMENTAL SAMPLING

- Purposive sampling refers to a **group of non-probability sampling techniques in which units are selected because they have characteristics that researcher needs in his sample**. In other words, units are selected “**on purpose**” in purposive sampling.
- The selection of sample depends upon the **judgement of researcher** on the basis of past experiences.
- Purposive sampling is common in **qualitative research and mixed method** research. It is particularly useful if a researcher needs to find information-rich cases or make the most out of limited resources.

PURPOSIVE OR JUDGEMENTAL SAMPLING

- **Researcher uses his judgement and decides that which portion of the population will sufficiently serve the purpose of his problem and leaves other portion of the population.**
- **Researcher selects the units of population which/who provides richest information and which are of most interest of researcher.**
- **Example: If a researcher wants to study the feeling of learners when they are learning through online courses he can take judgement to select registered learners from SWAYAM platform.**

LIMITATIONS

- prone to **bias**.
- The findings of studies based on either convenience or purposive sampling can only be generalized to the (sub)population from which the sample is drawn, and not to the entire population.

QUOTA SAMPLING

- Quota sampling method is similar to stratified random sampling. But it is non-randomly sample unit selection within each strata.
- First researcher has to identify the groups and sub-groups of interest, then determine the number of people to be Included in each strata and finally select the sample of each group.

QUOTA SAMPLING: EXAMPLE

- If a population of **1000 students** comprises of **700 boys** and **300 girls** then if we want to apply **Quota sampling technique**, in the sample of **100**, the **70 boys** and **30 girls** will be selected according to **researchers convenience not randomly**.

SNOW BALL OR CHAIN SAMPLING

- In this method participant who are voluntarily selected are asked to explore other people with the same characteristics and may be willing to participate in the study. Thus sample becomes larger and larger. It is viewed as snowball is rolling down a hill, and getting bigger and bigger in size.
- It is used when sampling frame is not available and it is difficult to locate the members for inclusion in the sample.
- Good for hidden population which is not easily identifiable.

SNOW BALL OR CHAIN SAMPLING: EXAMPLE

- To study of behaviour of students who are drug addicted.
- Difficulties faced by female administrator in their workplace.
- Socio-economic behaviour of ragged students etc.

DENSE SAMPLING

- When the researcher select **50% or more** from the population and takes a majority of individuals having specified traits or characteristic which are of **interest to him**, it is called dense sampling.
- Example: When a researcher wants to study the job satisfaction among private doctors in a city, suppose total no. of private doctors in that city are 1000.If he selects 50 % or 500 who are continuously serving since 10 years, it will be the example of dense sampling.

DOUBLE SAMPLING

- Double sampling is a **two-phase** method of sampling for an experiment, research project, or inspection. **An initial sampling run** is followed by **preliminary analysis**, after which **another sample is taken and more analysis** is run.

CONSIDERATIONS WHILE SELECTING A SAMPLE

- **Objectives of the study** – (for generalizing the results for whole population or providing the immediate solution of the problem)
- **Type of study** – (survey or experimental or qualitative)
- **Recourses available** – (time, cost, manpower, technical assistance)

THANKS

