

# Sampling Techniques

## ❖ Population (Universe)

Population means aggregate of all possible units. It need not be human population. It may be population of plants, population of insects, population of fruits, etc.

## ❖ Frame

A list of all units of a population is known as frame.

## ❖ Sample

A portion or small number of unit of the total population is known as sample.

- All the farmers in a village(population) and a few farmers(sample)

## ❖ Sampling

The method of selecting samples from a population is known as sampling.

## ❖ Survey

Studies that obtain data by interviewing people are called the survey.

## ❖ Sampling techniques

There are two ways in which the information is collected during statistical survey.

They are

1. Census survey and
2. Sample survey

### 1. Census survey

It is also known as population survey and complete enumeration survey. Under census survey the information are collected from each and every unit of the population or universe.

### 2. Sample survey

A sample is a part of the population. Information are collected from only a few units of a population and not from all the units. Such a survey is known as sample survey. The socio economic survey, the agricultural survey are the examples of sample survey.

**Example:** If we want to study the fishes of a lake then all the fishes in lake will constitute population. If we enumerate all the fishes then it is said to be census survey. If we enumerate only portion of all fishes in the lake then it is said to be sample survey.

Sampling technique is universal in nature, consciously or unconsciously it is adopted in everyday life.

For e.g.

- i. A handful of rice is examined before buying a sack.
- ii. We taste one or two fruits before buying a bunch of grapes.
- iii. To measure root length of plants only a portion of plants are selected from a plot.

### ❖ Sampling methods

The various methods of sampling can be grouped under

1. Probability sampling or random sampling
2. Non-probability sampling or non-random sampling

### ❖ Probability Sampling or Random sampling

Under this method, every unit of the population at any stage has equal chance (or) each unit is drawn with known probability. It helps to estimate the mean, variance etc of the population.

Under probability sampling there are two procedures

1. Sampling with replacement (SWR)
2. Sampling without replacement (SWOR)

When the successive draws are made with placing back the units selected in the preceding draws, it is known as sampling with replacement. When such replacement is not made it is known as sampling without replacement.

When the population is finite sampling with replacement is adopted otherwise SWOR is adopted.

Mainly there are many kinds of random sampling. Some of them are.

1. Simple Random Sampling
2. Systematic Sampling
3. Stratified Random Sampling
4. Cluster Sampling

### ❖ Simple Random Sampling (SRS)

The basic probability sampling method is the simple random sampling. It is the simplest of all the probability sampling methods. It is used when the population is homogeneous.

When the units of the sample are drawn independently with equal probabilities. The sampling method is known as Simple Random Sampling (SRS). Thus if the population consists of  $N$  units, the probability of selecting any unit is  $1/N$ .

There are two methods in SRS

1. Lottery method
2. Random no. table method

#### 1. Lottery method

This is most popular method and simplest method. In this method all the items of the universe are numbered on separate slips of paper of same size, shape and color. They are folded and mixed up in a drum or a box or a container. A blindfold selection is made. Required number of slips is selected for the desired sample size. The selection of items thus depends on chance.

For example, if we want to select 5 plants out of 50 plants in a plot, we number the 50 plants first. We write the numbers from 1-50 on slips of the same size, roll them and mix them. Then we make a blindfold selection of 5 plants.

#### 2. Random number table method

As the lottery method cannot be used when the population is infinite, the alternative method is using of table of random numbers.

There are several standard tables of random numbers. The widely used random number tables are:

- Tippet's random number tables
- Fisher and Yates tables
- Kendall and Smith tables.

❖ **Advantages of simple random sampling**

1. There is less chance for personal bias.
2. Sampling error can be measured.
3. This method is economical as it saves time, money and labor.

❖ **Disadvantages of simple random sampling**

1. It cannot be applied if the population is heterogeneous.
2. This requires a complete list of the population but such up-to-date lists are not available in many enquires.
3. If the size of the sample is small, then it will not be a representative of the population.

❖ **Stratified Sampling**

When the population is heterogeneous with respect to the characteristic in which we are interested, we adopt stratified sampling.

When the heterogeneous population is divided into homogenous sub-population, the sub-populations are called strata. From each stratum a separate sample is selected using simple random sampling. This sampling method is known as stratified sampling.

We may stratify by size of farm, type of crop, soil type, etc.

❖ **Advantages of stratified sampling**

1. It is more representative.
2. It ensures greater accuracy.
3. It is easy to administrate as the universe is sub-divided.

❖ **Disadvantages of stratified sampling**

1. To divide the population into homogeneous strata, it requires more money, time and statistical experience which is a difficult one.
2. If proper stratification is not done, the sample will have an effect of bias.

❖ **Systematic Sampling**

Systematic sampling is a method of sampling where sampling unit are selected at equal distances in the list of all the units of the population. This method is widely used when a complete list of the population is available.

In this method, first all the N units of the population are arranged in numerical, alphabetical, geographical or any other order. Then the samples units are selected from every k-th place, where  $k = \frac{N}{n}$  and n is the sample size. Here, the 1<sup>st</sup> unit is selected at random.

For example, let we have a complete list of 500 students in a University and we want to draw a sample of size 50, i.e.  $N=500$  and  $n=50$ .

Now select  $i$ ,  $1 \leq i \leq k$ , at random. Let  $i=4$ , then the 1<sup>st</sup> item selected for our desired sample is the 4<sup>th</sup> item on the list. The 2<sup>nd</sup> item would be  $(4+10)$  or 14<sup>th</sup> item. The 3<sup>rd</sup> item would be  $4+2(10)=24$ <sup>th</sup> item and so forth until the 50 items is not selected.

❖ **Advantages of systematic sampling**

1. In systematic sampling, the field work is not required at all.
2. This method is more convenient to adopt than the simple random sampling or stratified sampling.
3. Among all sampling methods the systematic sampling requires the least cost, time and labor.

❖ **Disadvantages of systematic sampling**

1. The systematic sampling procedure requires always a complete and up-to-date sampling frame.
2. When the population units follow a nonlinear random pattern that has not been seen beforehand then it may cause bias to the information.

❖ **Cluster Sampling**

In random sampling it is pre-assumed that the population has been divided into a finite number of distinct and identifiable units defined as sampling units.

The smaller unit, into which the population can be divided, is called an element of the population. The group of such element is known as cluster. When the sampling unit is a cluster, the procedure is called cluster sampling. The element of cluster are homogenous within and between clusters are heterogeneous.

e.g. An orange tree forms a cluster of oranges for investigating insect infestation.

❖ **Advantages of cluster sampling**

1. In cluster sampling, collection of data neighboring element is easier, cheaper, and faster.
2. Cluster sampling is less costly than then the simple random sampling due to the saving of time in journeys, identifications and contracts etc.
3. When the sampling frame of the elements may not be readily available, then we use cluster sampling.

❖ **Disadvantages of cluster sampling**

1. Cluster sampling is less efficient than simple random sampling.
2. Cluster sampling is not recommended if we have sampling areas in the city, where the private residential houses, business and industrial complexes etc. with widely varying number of persons or households.

❖ **Non-probability or non-random sampling**

The non-probability or non-random sampling is such a procedure of sample selection where the concept of randomization is avoided. In non-random sampling, a sample is selected on a basis other than probability consideration such as convenience, judgement etc.

The non-probability or non-random sampling can be classified as follows:

1. Judgement or purposive sampling
2. Convenient sampling
3. Quota sampling
4. Snowball sampling

#### ❖ **Judgement or Purposive Sampling**

In this sampling, the sample is selected with definite purpose in view and the choice of the sampling units depends entirely on the discretion and judgement of the investigator. In this procedure the investigator includes those items in the sample which are most representative of the population by his judgement.

For example, if an investigator wants to give the picture that the standard of living has increased in the city of Dhaka, he may take individuals in the sample from the posh localities like Dhanmondi, Uttara, Basundhara, Bonany, etc. and ignore the localities where low income group and middle class families live.

This sampling method is seldom used and cannot be recommended for general use since it is often biased due to element of subjectiveness or the part of the investigator. However, if the investigator is experienced and skilled and this sampling is carefully applied, then the judgement samples may yield valuable results.

#### ❖ **Advantages of judgement sampling**

1. When the sample size is small or the number of sampling units in the population is small then judgement sampling is more useful method than simple random sampling.
2. In solving many business problems public policy, disease related study judgement sampling is used.

#### ❖ **Disadvantages of judgement sampling**

1. The judgement sampling is not scientific method. Many times an investigator may draw a conclusion not realistic.
2. There is no objective way of evaluating the reliability of sample results.

#### ❖ **Convenient Sampling**

In this method, a sample is drawn on the basis of opportunity or convenient. For example, the sample could include youth attending in school activity, service providers (*doctors or nurse*) attending a conference or parents attending a school meeting.

❖ **Advantages of convenience sampling**

1. Convenience sampling is least expensive and least time consuming of all sampling techniques.
2. Data collection can be facilitated in short duration of time.
3. Helpful for pilot studies and hypothesis generation.

❖ **Disadvantages of convenience sampling**

1. Variability and bias cannot be measured or controlled.
2. Projecting data beyond sample not justified.

❖ **Quota Sampling**

This is a restricted type of purposive or judgement sampling. This consists of specifying quotas of the samples to be drawn from these strata and then drawing the required samples from these strata by judgement sampling.

The basic objective is to make the best use of stratification without incurring high costs, which may be involved in any probabilistic method of sampling. Sample quotas may be fixed according to some specified characteristics such as income group, sex, occupation, political or religious affiliation, etc.

❖ **Advantages of quota sampling**

1. Relatively easy to administer
2. Can be performed quickly
3. Cost effective.

❖ **Disadvantages of quota sampling**

1. Sample selection is not random.
2. There is a potential for selection bias, which can result in a sample that is unrepresentative of the population.

❖ **Snowball Sampling**

In this sampling method, data is collected from a small group of people with special characteristics, who are then asked to identify other people like them.

Then data is collected from these referrals that are also asked to identify other people like them. This process is continued until a target sample size has been reached or until an additional data collection yields no new information. This method is known as network or chance referral sampling.

❖ **Advantages of snowball sampling**

1. It allows for studies to take place where otherwise it might be impossible to conduct because of a lack of participants.
2. Snowball sampling may help us to discover the characteristics about a population that we weren't expect.

❖ **Disadvantages of snowball sampling**

- It is usually impossible to determine the sampling error or make inferences about populations based on the obtained sample.

❖ **Difference between random and non-random sampling (or probability and non-probability)**

The difference between random sampling and non-random sampling are given below:

1. The random sampling methods are those in which each and every item in the population has an equal chance to be included in the sample, whereas non-random sampling is a procedure of sample selection where the concept of randomization is avoided.
2. Some random sampling are-simple random sampling, stratified sampling, systematic sampling, cluster sampling. Whereas some non-random sampling are-judgement sampling, convenience sampling, quota sampling, snowball sampling.
3. In random sampling the selection probability of a sample unit is known beforehand but we have no such knowledge in a non-random sampling.
4. We can estimate the pattern of sampling variability in case of random sampling, whereas it is impossible in non-random sampling.
5. Random sampling is used for large sample but non-random sampling generally use for small sample.