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QUADRANT –I

1. Module 8: Sampling Design
2. Learning Outcome
3. Sampling
4. Need for a sample
5. Attributes of a good sample
6. Types of sampling
Summary

1. Module 8: Sampling Design

2. Learning Outcome

After finishing this module, you shall be able to:

- ❖ Know the need of a sample,
- ❖ Understand attributes of a good sample
- ❖ Comprehend the parameter of interest
- ❖ Know the types of sampling

3. Introduction

The way of selecting for study a fraction of the universe with a view to draw conclusion about the universe or population as a whole is known as sampling. A population is the full collection of individuals, objects, occurrences or things that a researcher intends to study. However, in several a population study may not be accomplished so the researcher selects a sample or a subset of the target population. Sampling methods consist of different ways of choosing the sample from the target population. Some of the sampling methods aim at obtaining a representative sample of the population. Generalizing the results of the study to the rest of the population can then be made. However, if a sample is biased, generalizing from the sample to the population may lead to incorrect inferences. In most of the research work and surveys the usual approach taken is to generalize or to draw inferences on the basis of samples about the parameters of population. So a sample may be explained as any number of persons, units or objects chosen to symbolize the population in accordance with some rule or plan.

4. The Need of a Sample

There are large economic benefits of selecting a sample rather than conducting a census. The cost of taking a census survey may go up to lakhs of rupees interviewing all 5000 employees of an organization. It can be identified what is to be known by choosing a sample of few hundred. The quality of a study conducted with a sample is usually more than with a population. Research findings provide competent evidence of this opinion. In one study, more than 90 percent of the total survey error was from non-sampling sources, and only 10 percent was error from random sampling.

The results of a study from are quicker than from a study of census. The speed of execution reduces the time between recognizing of a requirement for data and the data within reach.

When the population of the study is small and the variability high, as well as the components completely different from each other, the census study is more appropriate. If the universe is small and the variability is high, the selected sample may not be representative of the universe. The results drawn from the sample are not accurate as estimates of the population values. When the sample is taken appropriately, however, some sample elements underestimate the parameters and some other overestimates them. Variations in these values act in opposition to each other this counteraction arises in a sample values that is usually near to the population value. For these offsetting effects to happen, however, there must be adequate members in the sample, and they must be drawn in a way that neither underestimation nor overestimation occurs.

5. Attributes of a good sample

The decisive test of a sample design is the extent to which a sample is representative of the population. The sample must be valid in terms of accuracy and precision.

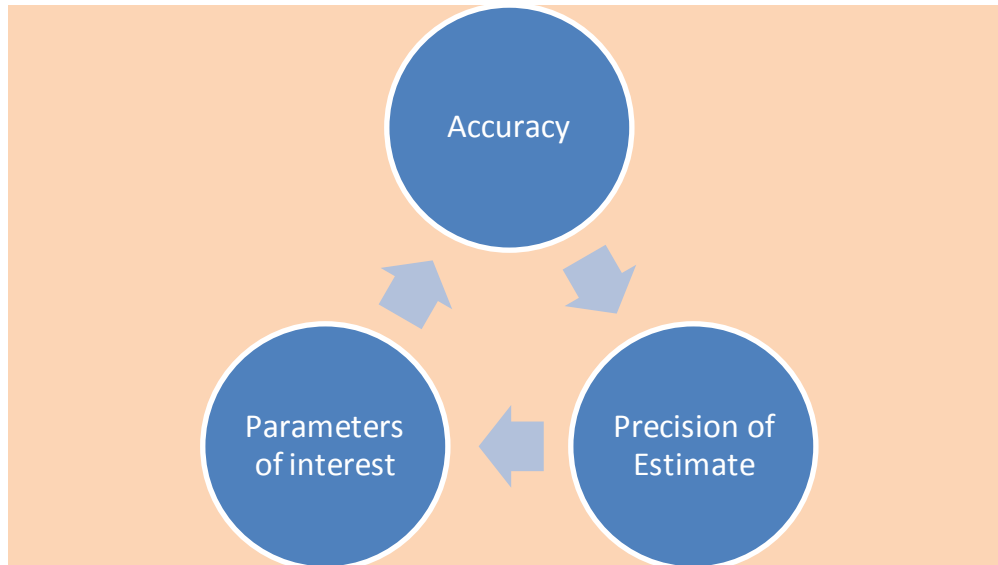


Figure 1 Attribute of a good sample

5.1 Accuracy

Accuracy is the extent to which bias is nonexistent from the sample. In an exact sample the under estimator and the over estimators are adjusted among the members of the sample.

From an accurate sample, the systematic variance is absent. The variation in measures some known or unknown effects create resulting in the inclination of scores in one direction more than another. In a study the researcher came to know that in selecting a particular route for his newspaper readership sample, the time of the day, day of the work, and season of the year of the survey strikingly brought down the accuracy and validity of his sample. A classic example of a sample with systematic variance was the presidential election poll in 1936, in which greater than 2 million persons took part. The poll said Alfred Landon would win against Franklin Roosevelt for the presidency of the US. Even the large size of this sample did not counteract its systematic bias. Later evidence exhibited that the poll selected its sample from the middle and upper classes, while Roosevelt's appeal was largely among the much larger working class.

5.2 Precision of Estimate

The precision of estimate is another criterion of a good sample design. No sample will entirely represent its universe in all respects. The numerical descriptors that give an account of the sample may be expected to differ from those that describe population due to of random fluctuations in the process of sampling. This sampling error indicates the effects of chance in selecting the sample unit remains after all understood sources of systematic variance have been taken into consideration. Sampling error is composed of random fluctuations only, although some systematic variance not known may be contained in when too many or too few sample members possess a particular feature.

The standard error of estimate, a measure of standard deviation, gauges the precision; the low value of the standard error of estimate indicates the high degree of precision of estimate of the sample. An appropriate sample design creates a small standard error of estimate. However, all kinds of sample design do not provide estimates of precision, and samples of the same size can generate different amounts of error variance.

5.3 Parameters of interest

Universe parameters are hard but easily breakable descriptors of interest variables within the universe. Sample statistics are descriptors of the relevant variable computed from sample information. Sample statistics estimate population parameters and constitutes the premise of our inferences regarding the population as a result that they are the simplest estimates of the population.

When the variables of interest of the study are measured on interval scale or quantitative relation scale, the sample mean is employed to estimate the population average and also the sample variance is employed to estimate the population variance.

If a study focuses on nominally scaled data, the population proportion parameter would be of interest. Proportion measures are essential for nominal data and are extensively applied to measures also. The percentage is the most frequent concentration measures; the variance equivalent is the pq ratio.

6. Type of Sampling

Largely there are two kinds of sampling: Probability and non-probability sampling

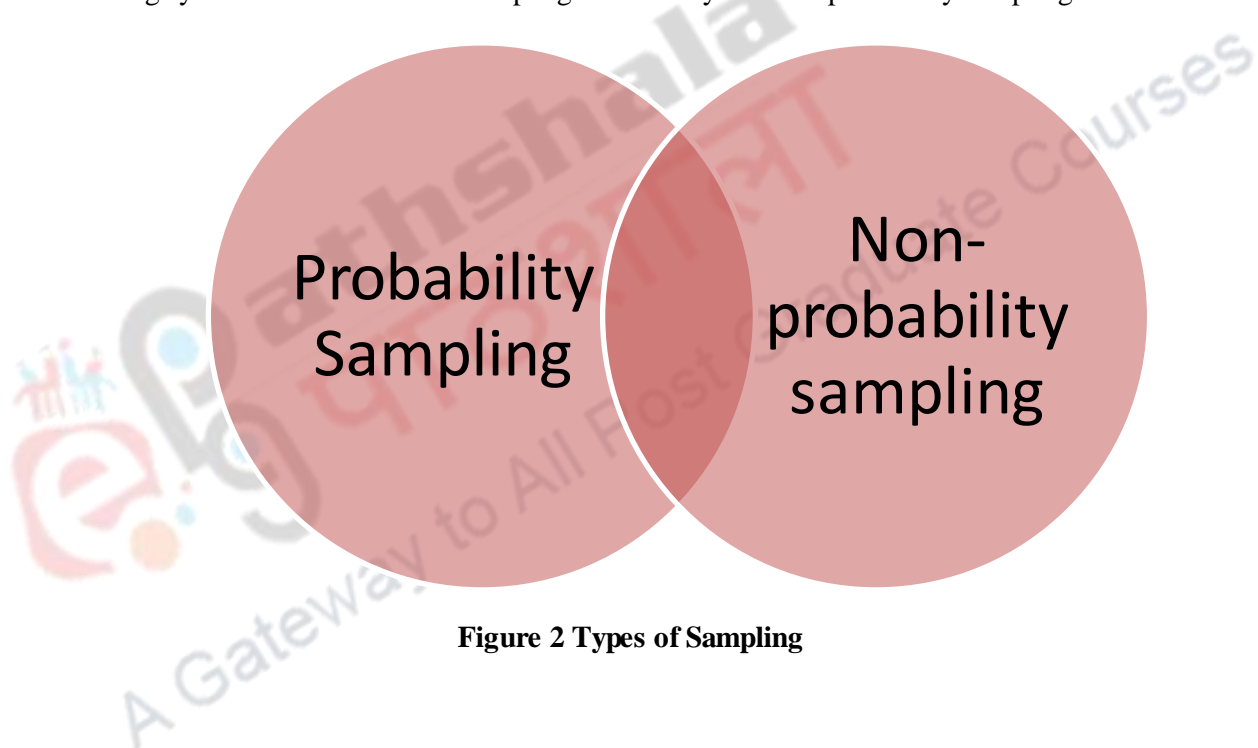


Figure 2 Types of Sampling

6.1 Probability Sampling

The major types of probably sampling include simple random sampling, stratified sampling and cluster sampling

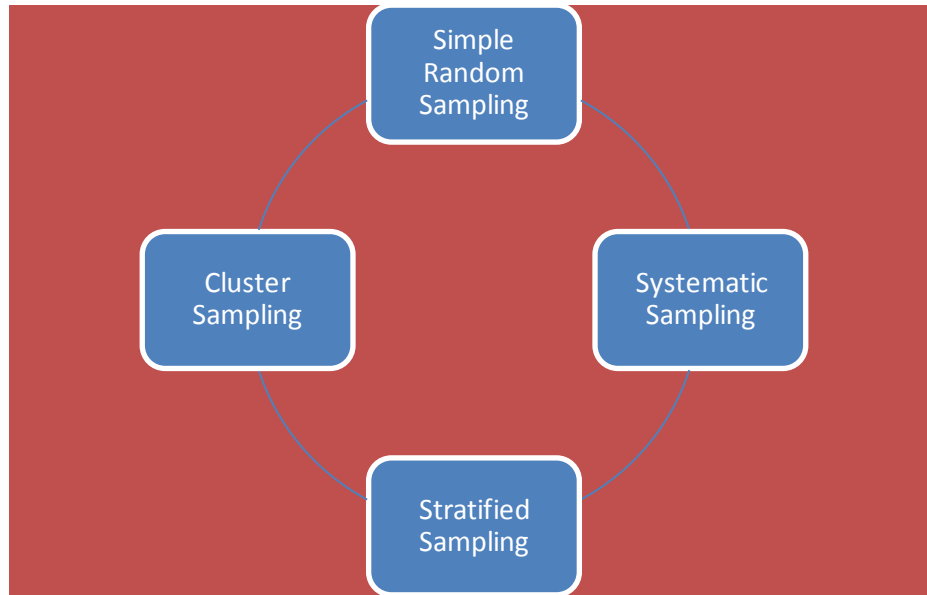


Figure 3 Types of Probability Sampling

6.1.1 Simple random sampling

Almost all scientific sampling discuss the subject of the simple random sampling. All other methods of scientific sampling are degrees of change of the simple random sampling. The simple random sample is the basic sampling method supposed in statistical methods and computations.

An important advantage of simple random sampling is that it permits researchers to apply statistical techniques for the analysis of sample results. For example, with a specified simple random sample, researchers can apply statistical methods to explain a confidence interval around a sample mean. Statistical analysis is not suitable for non-random sampling methods. There are several ways to get a simple random sample. One is the lottery method. Each of the N population members gets a unique number and placed in a bowl and thoroughly mixed. Then, a blind-folded person selects n numbers. Population members having been selected are included in the sample.

The simple random sampling denotes that every member of the universe has an equal chance of being selected in the sample but also makes the selection of each possible combination of the needed number of cases equally likely. It ensures that the selected sample is representative of the population. Also the statistical conclusions drawn from analysis of the sample will be well founded. Alternatively a random number table may also be used for selection of the sample.

Sampling with replacement is a type of random sampling in which members or items of the population can be selected greater than once for inclusion in the sample. For instance 100 names each written on a slip of paper kept into a bowl and mixed up. The researcher picks a name from the bowl, records this information to contain that person in the sample, then keeps the name back in the bowl, mixes up the names, and chooses another piece of paper. The unit just chosen in the sample has the equal probability of being selected again. This is sampling with replacement. The procedure for simple random sampling without replacement is same to simple random sampling with replacement, the difference being that the selected slip is not mixed in the box.

6.1.2 Systematic Sampling

The systematic sampling also employs the principle of Random Sampling. However, in this method of sampling the selection of a unit depends upon the selection of a preceding unit in contrast to Simple Random Sampling which selects units independent of each other. Systematic Random sampling in this sense is called quasi-random sampling. In systematic sampling, the researcher randomly makes an entry in to a stream of components and sample each k element. It is best once elements are randomly arranged with no cyclic variation. In this sampling, the sample is systematically spread through the population.

In a systematic sample, the elements of the population are arranged in the form a list and then every k th element from the list is selected (systematically) for including in the sample. For example, if the population of study consisted of 2,000 students at a level and the researcher desired to select a sample of 100 students, the students would be arranged in a list and then every 20th student is selected for inclusion in the sample. In order to avoid any possible human bias in systematic sampling, the researcher selects the first unit at random. The method to select a systematic random sample is quite easy and can be carried out manually. First, the researcher chooses a number that is less than the total number of units in the universe. This number will be related to the first unit chosen for the sample. Then, the researcher determines the sampling interval, the standard distance between elements included in the sample.

We can calculate the sampling interval through dividing the population size by the sample size. For instance, if the population is 10,000 and the desired sample is 1,000, the investigator selects every tenth unit for the sample.

The systematic sampling is simple and permits the researcher to add a systematic element into the random selection of subjects. This method guarantees that the population is evenly sampled. Human bias is consistently removed in systematic sampling as a result of the sample components are at the same distance within the universe.

6.1.3 Stratified Sampling



Figure 4 Stratified Sampling (Adapted from study.com)

The stratified random sampling involves initially the division of the population into a number of strata based on one criterion or a union of two or more criteria, giving strata such as males below 35 years and males above 35 years, females below 35 years and females above 35

years. In stratified random sampling, a simple random sample is drawn from each stratum, and such sub-samples are brought together to form the total sample. The sampling results can then be given weight and joined into suitable population estimates. The process of stratification of the universe increases the efficiency of sampling if categories are made based on some strata. The two possible grounds of stratification can be the age and gender of the units of sampling. Stratification based on of gender give two strata differing distinctly from each other in regard to their scores on features under study. However, stratification on the basis of age does not create strata markedly different from one another. The criterion of ex will be the more effective basis of stratification in this case. Stratification does not deal with designing the sample a reproduction of the population and similar to simple random sampling intends representative sampling. Each stratum is identical internally and different with other strata and would be based on primary variable under study

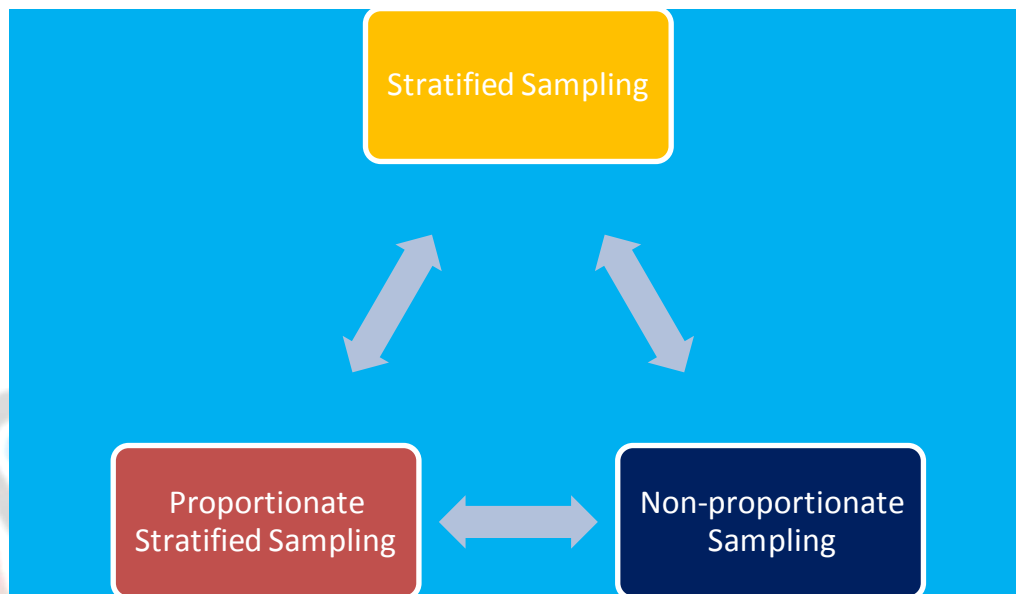


Figure 5 Types of Proportionate Sampling

6.1.3.1 Proportionate stratified sampling

In proportionate sampling the cases are chosen from each stratum in the same proportion as they are in the population. For example, if it is known that male constitutes 60% of the population and the female remaining 40% proportionate sampling would consist in taking a sample in a manner that results in same categories among sexes in the sample. The proportionate stratified sampling ensures an appropriate representation of attributes or variables considered most significant for the study.

6.1.3.2 Disproportionate stratified sampling

A disproportionate stratified sample is one in which the number of units chosen from the strata does not depend upon the size of these strata

There are many disproportionate allocation plans. One kind may be a judgmentally decided disparity on the basis of the idea that each stratum is adequately large to secure enough confidence levels and interval range estimates for individual strata. Decisions regarding disproportionate sampling, however, are made by considering how a sample will be allocated among strata. If there are large differences in costs of sampling or large variances

among strata, then disproportionate sampling is preferable. ‘Differences of several-fold are required to make disproportionate sampling desirable.

6.1.4 Cluster sampling

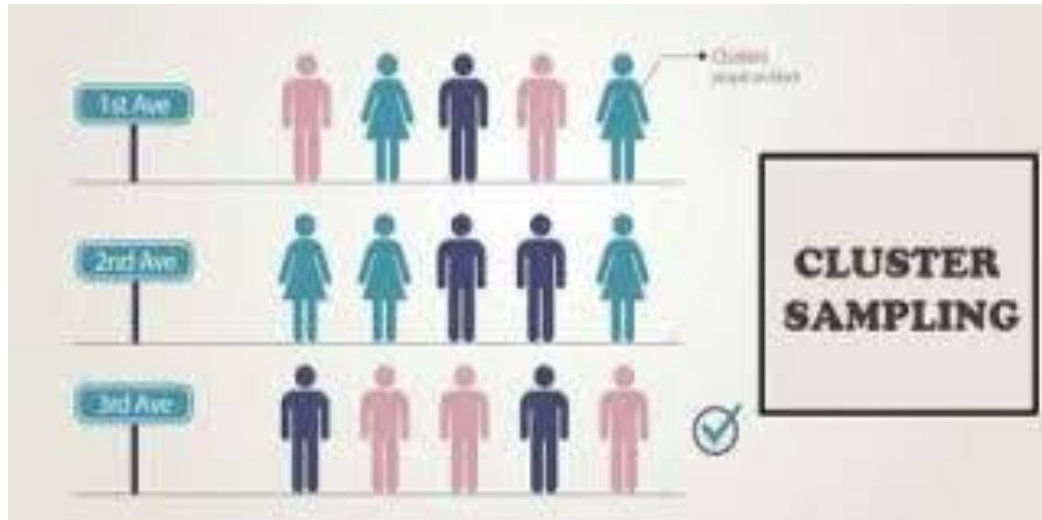


Figure 6 Cluster Sampling (Adapted from accountlearning.com)

In cluster sampling, the research first draws a definite large groupings or clusters from the population. These clusters may be city-wards, households or any geographical or social units. Simple or stratified random sampling methods are used for sampling of clusters from the population. The sampling of constituent components is carried out using random procedures from the chosen clusters. Thus, a probability sample of components having more or less geographical concentration is obtained.

It is a multi-stage sampling as the sampling procedure goes through different stages. The researcher navigates from the more inclusive to the less encompassing sampling until he ultimately arrives at the population components constituting the needed sample. With cluster sampling now every combination of the intended number of components in the population is not equally likely to be selected in the sample. In the cluster sampling the margin of error is high.

6.2 Non-probability sampling

Non-probability samples do not employ random sampling. They do not possess the virtues of probability sampling and do not make estimate the probability of each element in the population of being selected in the sample. Still, they are usually essential and inevitable. Their shortcoming can to some extent be reduced by making application of knowledge, expertise, and concern in selecting samples and by reproduce studies with different samples.

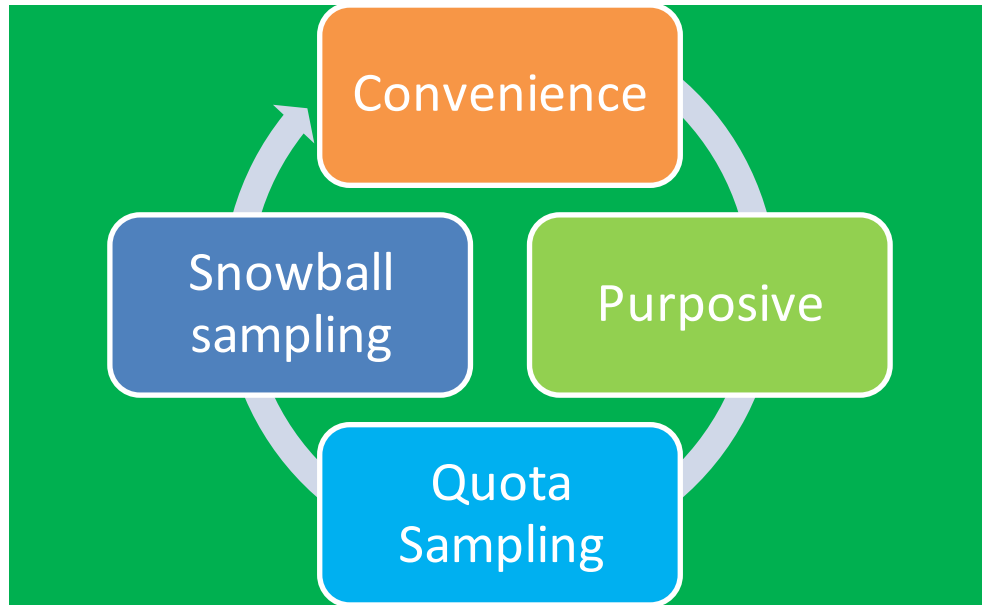


Figure 7 Types of Non-Probability Sampling

6.2.1 **Convenience Sampling**

Convenience sampling is a variant of non-probability sampling where subjects are chosen due to their convenience access and nearness to the researcher. The subjects are chosen just because they are easiest to be approached for the study and the researcher did not think carefully selecting subjects that have the characteristics of the whole population.

In all forms of research, it would be appropriate to test the whole population, but in majority of cases, the population is too large to make it impossible for inclusion of every person. This is why most researchers depend on sampling procedures like convenience sampling. Since it is quick, economical, easy, ready availability of the subjects, many researchers hold convenience sampling above other methods. .

Very common example of convenience sampling is selecting students as subjects for the research. Other examples are subjects selected from a clinic, a class or an institution easily accessible to the researcher. In such examples, the researcher unintentionally keeps out a large proportion of the population.

6.2.2 **Purposive Sampling**

The use of judgment and a careful consideration to attain representative samples by containing presumably typical areas or groups in the sample are the characteristics of purposive sampling. While using purposive sampling the researcher chooses sample with an *objective* in mind having one or more specific predetermined groups.

For instance, we come across persons in a mall or on the road having a clipboard, intercepting people and questioning if they could interview them. Most probably they are taking a purposive sample required for market research.

Purposive sampling can be helpful in situation where the investigator reaches a targeted sample quickly and where proportion of the sample is not the major concern. In this type of sampling, the researcher most probably gets the opinions of his target population, but is also likely to give more weight to subgroups in population that are more readily accessible.

Methods like quota sampling, and snowball sampling are subcategories of purposive sampling.

6.2.3 Quota sampling

In quota sampling understanding of the strata of the population e.g. sex, race, region and so on, is utilized to choose representative, typical and suitable sample members for predefined research purposes. In quota sampling, the investigator selects individuals non-randomly according to some specific quota. Usually two kinds of quota sampling are: proportional and non-proportional. The investigator desires to represent the chief characteristics of the population by sampling a proportion of each stratum in proportional quota sampling. For example, if the population has a ratio of 40% women and 60% men, and a total sample size of 100 is desired, sampling continues until those percentages in the sample are obtained. The problem with quota sampling is to decide the specific characteristics on which to base the quota e.g. gender, age, education, race, religion, etc.

6.2.4 Snowball

Snowball sampling begins by identifying individuals who fulfill the criteria for inclusion in the study. Then, they are requested to give references of their known persons satisfying the criteria. Although this method would not create representative samples, there are occasions when it may be the best method available. Snowball sampling is especially useful when the researcher is trying to reach inaccessible or hard to find populations. For instance, if the homeless are being studied, one may not be able to find listing of homeless people in a particular geographical area. However, going to that area and identifying some persons, further they may know very well who the other homeless people in their vicinity are and how they can be found out.

Summary

The way of selecting for study a fraction of the universe with a view to draw conclusion about the universe or population as a whole is known as sampling.

There are large economic benefits of selecting a sample rather than conducting a census. A good sample must have the characteristics of accuracy, precision of estimate and parameters of interest. There are two types of sampling, probability and non-probability sampling. The major types of probability sampling include simple random sampling, stratified sampling and cluster sampling. The simple random sampling denotes that every member of the population has an equal probability of being included in the sample but also renders the selection of every feasible combination of the desired number of cases equally likely.

In systematic sampling, we randomly enter a stream of elements and sample every k element. It is best when elements are randomly ordered with no cyclic variation. In this sampling, the sample is systematically spread through the population.

In stratified random sampling, from each stratum a sample is drawn using a simple random sampling, and such sub-samples are brought together to form the total sample. In cluster sampling, the sampler first samples from the population certain large groupings or clusters. From these clusters the constituent components are sampled by random procedures.

Non-probability samples do not possess the virtues of probability sampling and do not make estimate the probability of each element in the population of being selected in the sample.

In convenience sampling the subjects are chosen just because they are easiest to be approached for the study and the researcher did not think carefully selecting subjects that have the characteristics of the whole population.

The use of judgment and a careful consideration to attain representative samples by containing presumably typical areas or groups in the sample are the characteristics of purposive sampling.

In quota sampling understanding of the strata of the population e.g. sex, race, region and so on, is utilized to choose representative, typical and suitable sample members for predefined research purposes. Snowball sampling begins by identifying individuals who fulfill the criteria for

inclusion in the study. Then, they are asked to recommend others whom they may know also meet the criteria.

