SAMPLING DESIGN

Census and Sample Survey

A survey may be conducted by either of two methods.

1. Census Method or Parametric method and

2. Sampling method or Non-parametric method

Population and Census

We have a collection of units relevant for a particular enquiry. A unit, in this connection, is an entity on which observations are made according to a well-defined procedure. The entire collection of such units is called a population or universe. Thus, we may have a population of human beings, cattle, trees, prices, production, etc.

Census method deals with the investigation of the entire population. Here the data are collected for each and every unit of the universe. This method provides more accurate and exact information as no unit is left out.

This type of inquiry involves a great deal of time, money and energy. Therefore, when the field of inquiry is large, this method becomes difficult to adopt because of the resources involved. At times, this method is practically beyond the reach of ordinary researchers. Perhaps, government is the only institution which can get the complete enumeration carried out. Even the government adopts this in very rare cases such as population census conducted once in a decade.

Sampling method

When field studies are undertaken in practical life, considerations of time and cost almost invariably lead to a selection of respondents i.e., selection of only a few items. The respondents selected should be as representative of the total population as possible in order to produce a miniature cross-section. The selected respondents constitute what is technically called a ‘sample’ and the selection process is called ‘sampling technique.’ The survey so conducted is known as ‘sample survey’. Algebraically, let the population size be N and if a part of size n (which is < N) of this population is selected according to some rule for studying some characteristic of the population, the group consisting of these n units is known as ‘sample’. Researcher must prepare a sample design for his study i.e., he must plan how a sample should be selected and of what size such a sample would be.

Concepts in Sampling

Sample: A sample is a miniature representation of and selected from a larger group or aggregate. In other words, the sample provides a specimen picture of a larger whole.

Population: the larger whole is termed as the population or universe.

Sampling Units and Population: a unit may be taken as a well-defined and identifiable element or a group of elements on which observations can be made. The aggregate of these units is termed as population and the population is said to be finite, if the units are countable. The population is sub-divided into suitable small units known as sampling units for the purpose of sampling. Sampling units may consist of one or more elementary units and each elementary unit belongs to one and one sampling unit.

Sampling Frame: a sampling frame is a list of sampling units with identification particulars indicating the location of the sampling units. A sampling frame represents the population under investigation, and it is the base of drawing a sample. As far as possible, it should be up-to-date, i.e., free from omissions and duplications.

Sampling Procedure/Method: this is the method of selecting a sample from a population.

Parameter: In a statistical inquiry, our interest lies in one or more characteristics of the population. A measure of such a characteristic is called a *parameter*. Parameters are conventionally denoted by Greek alphabets. For example, the population mean can be denoted by μ and population standard deviation can be denoted by σ.

It is important to note that the value of a parameter is computed from all the population observations. Thus, we can define a parameter as a function of the population values.

Statistic: the function of the values of the units in the sample, such as sample mean and sample variance, is known as a statistic. The value of the mean and variance differ from sample to sample and, therefore, it is a random variable.

Sampling Advantages

Some of the key advantages of sampling are:

- it costs less
- takes less time
- data are acquired quickly
- fewer mistakes are likely
- a more detailed study can be done.

STEPS IN SAMPLE DESIGN

A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample. While developing a sampling design, the researcher must pay attention to the following points:

Type of universe: The first step in developing any sample design is to clearly define the set of objects, technically called the Universe, to be studied. The universe can be finite or infinite. In finite universe the number of items is certain, but in case of an infinite universe the number of items is infinite, i.e., we cannot have any idea about the total number of items. The population of a city, the number of workers in a factory and the like are examples of finite universes, whereas the number of stars in the sky, listeners of a specific radio programme, throwing of a dice etc. are examples of infinite universes.

Sampling unit: A decision has to be taken concerning a sampling unit before selecting sample. Sampling unit may be a geographical one such as state, district, village, etc., or a construction unit such as house, flat, etc., or it may be a social unit such as family, club, school, etc., or it may be an individual. The researcher will have to decide one or more of such units that he has to select for his study.

Source list: It is also known as 'sampling frame' from which sample is to be drawn. It contains the names of all items of a universe (in case of finite universe only). If source list is not available, researcher has to prepare it. Such a list should be comprehensive, correct, reliable and appropriate. It is extremely important for the source list to be as representative of the population as possible.

Size of sample: This refers to the number of items to be selected from the universe to constitute a sample. This is a major problem before a researcher. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility.

Parameters of interest: In determining the sample design, one must consider the question of the specific population parameters which are of interest.

Budgetary constraint: Cost considerations, from practical point of view, have a major impact upon decisions relating to not only the size of the sample but also to the type of sample. This fact can even lead to the use of a non-probability sample.

Sampling procedure: Finally, the researcher must decide the type of sample he will use i.e., he must decide about the technique to be used in selecting the items for the sample. In fact, this technique or procedure stands for the sample design itself. There are several sample designs (explained in the pages that follow) out of which the researcher must choose one for his study. Obviously, he must select that design which, for a given sample size and for a given cost, has a smaller sampling error.

Sampling and Non-sampling Errors

The errors involved in the collection of data are classified into sampling and non-sampling errors.

Sampling Errors: sampling errors arise due to the fact that only a part of the population has been used to estimate population parameters and to draw inferences about the population. Sampling errors are absent in census survey. Sampling error can be measured for a given sample design and size. The measurement of sampling error is usually called the *'precision of the sampling plan*'. If we increase the sample size, the precision can be improved. But increasing the size of the sample has its own limitations *viz*., a large sized sample increases the cost of collecting data and also enhances the systematic bias. Thus the effective way to increase precision is usually to select a better sampling design which has a smaller sampling error for a given sample size at a given cost.

Non-sampling Errors: Non-sampling errors arise at the stage of collection and preparation of data and thus are present in both sample survey as well as thee census survey. Thus the data obtained in census survey is free from sampling errors, however subjected to non-sampling errors. Non-sampling errors can be reduced by defining the sampling units, frame and the population correctly and by employing efficient people in the investigations.

Types of Sampling Designs

The method of selecting a sample is of fundamental importance and depends upon the nature of data and investigation. The techniques of selecting a sample are classified as;

i. Probability sampling
ii. Non-probability sampling

Probability sampling

Probability sampling is based on random selection of units from a population. In other words, the sampling process is not based on the discretion of the researcher but is carried out in such a way that the probability of every unit in the population of being included is the same. For example, in the case of lottery, every individual has equal chance of being selected. Some of the characteristics of a probability sample are:

- each unit in the sample has some probability of entering the sample,
- weights appropriate to the probabilities are used in the analysis of the sample, and
- the process of sampling is automatic in one or more steps of the selection of units in the sample.

Probability sampling can be done through different methods, each method having its own strengths and limitations. A brief account of these is given below: