

Chapter 2

INTRODUCTION TO SAMPLING METHODS

Introduction:

Sampling is very often used in our daily life. For example while purchasing food grains from a shop we usually examine a handful from the bag to assess the quality of the commodity. A doctor examines a few drops of blood as sample and draws conclusion about the blood constitution of the whole body. Thus most of our investigations are based on samples. In this chapter, let us see the importance of sampling and the various methods of sample selections from the population.

2.2 Population:

- Population : is a complete set of all possible observations of the type which is to be investigated
- **Example** : Total number of students studying in a school or college, total number of books in a library
- **Complete enumeration, or census** : examine every person or item in the population we wish to describe

2.2.1 Finite population and infinite population:

- **Finite population** : consists of finite number of units
- **Example** : Number of workers in a factory>
- **infinite population** : consists of infinite number of units
- **Example** : the number of stars in the sky, the number of people seeing the Television programmes etc
- **population size** : The total number of units in a population

2.2.2 Census Method:

- Information on population can be collected in two ways - sample method and census method

1- census method :every element of the population is included in the investigation

example, if we study the average annual income of the families of a particular village or area, and if there are 1000 families in that area, we must study the income of all 1000 families. In this method no family is left out, as each family is a unit.

2.2.3 Merits and limitations of Census method:

- **Merits:**

1. The data are collected from each and every item of the population
2. The results are more accurate and reliable, because every item of the universe is required.
3. Intensive study is possible.
4. The data collected may be used for various surveys, analyses etc

2.2.3 Merits and limitations of Census method:

Limitations:

1. It requires a large number of enumerators and it is a costly method
2. It requires more money, labour, time energy etc.
3. It is not possible in some circumstances where the universe is infinite.

2.3 Sampling:

The theory of sampling has been developed recently but this is not new. In our everyday life we have been using sampling theory as we have discussed in introduction. In all those cases we believe that the samples give a correct idea about the population.

Most of our decisions are based on the examination of a few items that is sample studies.

2.3.1 Sample:

Sample: A finite subset of statistical individuals

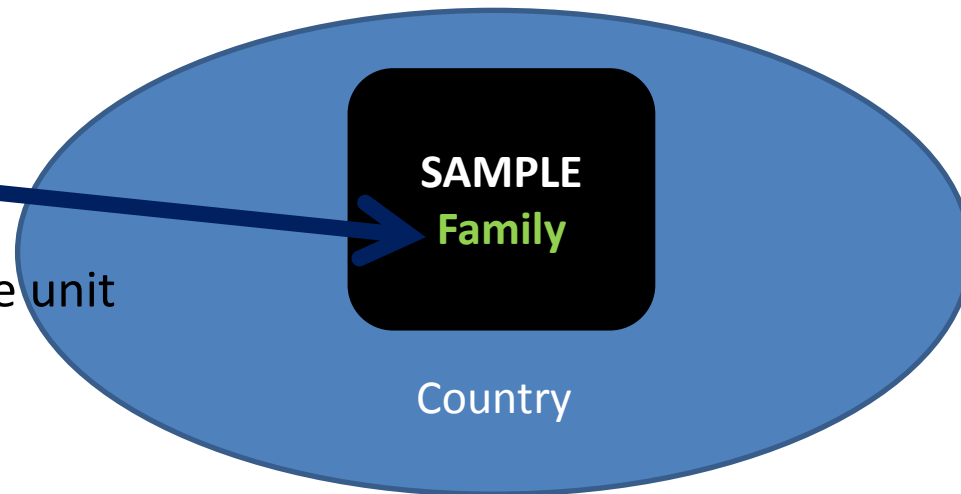
- defined in a population.

sample size : The number of units in a sample
example, to know the average income per family.

Sampling unit

Sampling frame

List of family in this sample unit



2.3.2 Reasons for selecting a sample:

- Sampling is inevitable in the following situations:
 1. Complete enumerations are practically impossible when the population is infinite.
 2. When the results are required in a short time.
 3. When the area of survey is wide.
 4. When resources for survey are limited particularly in respect of money and trained persons.

2.3.3 Parameters and statistics:

- We can describe samples and populations by using measures such as the mean, median, mode and standard deviation.

parameter is a characteristic of a population

statistic is a characteristic of a sample

when the parameters are unknown, they are estimated from the values of the statistics.

2.3.3 Parameters and statistics:....cont...

- In general, we use Greek or capital letters for population parameters and lower case Roman letters to denote sample statistics. [N , μ , s , are the standard symbols for the size, mean, S.D, of population.
- n , \bar{x} , s , are the standard symbol for the size, mean, s.d of sample respectively].

2.3.4 Principles of Sampling:

Samples have to provide good estimates. The following principle tell us that the sample methods provide such good Estimates .

1. Principle of statistical regularity:

A moderately large number of units chosen at random from a large group are almost sure on the average to possess the characteristics of the large group.

2. Principle of Inertia of large numbers:

Other things being equal, as the sample size increases, the results tend to be more accurate and reliable.

2.3.4 Principles of Sampling:

3. Principle of Validity:

This states that the sampling methods provide valid estimates about the population units (parameters).

4. Principle of Optimisation:

This principle takes into account the desirability of obtaining a sampling design which gives optimum results. This minimizes the risk or loss of the sampling design.

Cont.....

- **Sampling errors and non-sampling errors:**
- **1. Sampling errors:**
- Although a sample is a part of population, it cannot be expected generally to supply full information about population. So there may be in most cases difference between statistics and parameters. The discrepancy between a parameter and its estimate due to sampling process is known as **sampling error**.

Cont.....

- **2. Non-sampling errors:**
- In all surveys some errors may occur during collection of
- actual information. These errors are called Non-sampling errors

2.3.5 Advantages of Sampling:

1. Sampling saves time and labour.
2. It results in reduction of cost in terms of money and man-hour.
3. Sampling ends up with greater accuracy of results.
4. It has greater scope.
5. It has greater adaptability.

2.3.5 Limitation of Sampling:

1. Sampling is to be done by qualified and experienced persons. Otherwise, the information will be unbelievable.
2. Sample method may give the extreme values sometimes instead of the mixed values.
3. There is the possibility of sampling errors. Census survey is free from sampling error.

2.4 Types of Sampling:

The sampling procedures which are commonly used may be classified as

1. Probability sampling.
2. Non-probability sampling.
3. Mixed sampling.

2.4.1 Probability sampling (Random sampling):

- A probability sample is one where the selection of units from the population is made according to known probabilities. (eg.)
- Simple random sample, probability proportional to sample size etc

2.4.2 Non-Probability sampling:

It is the one where discretion is used to select 'representative' units from the population (or) to infer that a sample is 'representative' of the population. This method is called **judgement or purposive sampling.etc**

2.4.3 Mixed Sampling:

Here samples are selected partly according to some probability and partly according to a fixed sampling rule; they are termed as mixed samples and the technique of selecting such samples is known as **mixed sampling**.

2.5 Methods of selection of samples:

Here we shall consider the following three methods:

1. Simple random sampling.
2. Stratified random sampling.
3. Systematic random sampling.

1. Simple random sampling:

- A simple random sample from finite population is a sample selected such that each possible sample combination has equal probability of being chosen. It is also called unrestricted random sampling.

2. Simple random sampling without replacement:

- In this method the population elements can enter the sample only once (ie) the units once selected is not returned to the
- population before the next draw.

3. Simple random sampling with replacement:

In this method the population units may enter the sample more than once. Simple random sampling may be with or without replacement.

2.5.1 Methods of selection of a simple random sampling:

- The following are some methods of selection of a simple random sampling.
- **a) Lottery Method**
- **b) Table of Random numbers:**
- There are several standard tables of random numbers.
- 1. Tippett' s table
- 2. Fisher and Yates' table
- 3. Kendall and Smith' s table are the three tables among
- them.

Example 1:

- In an area there are 500 families. Using the following extract from a table of random numbers select a sample of 15 families to find out the standard of living of those families in that area.

4652 3819 8431 2150 2352 2472 0043 3488

9031 7617 1220 4129 7148 1943 4890 1749

2030 2327 7353 6007 9410 9179 2722 8445

0641 1489 0828 0385 8488 0422 7209 4950

Solution:

- In the above random number table we can start from any row or column and read three digit numbers continuously row-wise
- or column wise.
- Now we start from the third row, the numbers are:
- 203 023 277 353 600 794 109 179
- 272 284 450 641 148 908 280

Solution:

- Since some numbers are greater than 500, we subtract 500 from those numbers and we rewrite the selected numbers as follows:
- 203 023 277 353 100 294 109 179
- 272 284 450 141 148 408 280

c) Random number selections using calculators or computers:

- Random number can be generated through scientific calculator or computers. For each press of the key get a new
- random numbers. The ways of selection of sample is similar to that of using random number table.
- <http://www.randomizer.org/form.htm>

2.5.2 Stratified Random Sampling:

- Of all the methods of sampling the procedure commonly used in surveys is stratified sampling. This technique is mainly
- used to reduce the population heterogeneity and to increase the efficiency of the estimates. Stratification means division into
- groups.

2.5.2 Stratified Random Sampling:

- In this method the population is divided into a number of subgroups or strata. The strata should be so formed that each stratum is homogeneous as far as possible. Then from each stratum a simple random sample may be selected and these are combined
- together to form the required sample from the population

Example 2:

- A sample of 50 students is to be drawn from a population consisting of 500 students belonging to two institutions A and B.
- The number of students in the institution A is 200 and the institution B is 300. How will you draw the sample using proportional allocation?

Solution:

There are two strata in this case with sizes $N_1 = 200$ and $N_2 = 300$ and the total population $N = N_1 + N_2 = 500$

The sample size is 50.

If n_1 and n_2 are the sample sizes, N

$$n_1 = \frac{n}{N} \times N_1 = \frac{50}{500} \times 200 = 20$$

$$n_2 = \frac{n}{N} \times N_2 = \frac{50}{500} \times 300 = 30$$

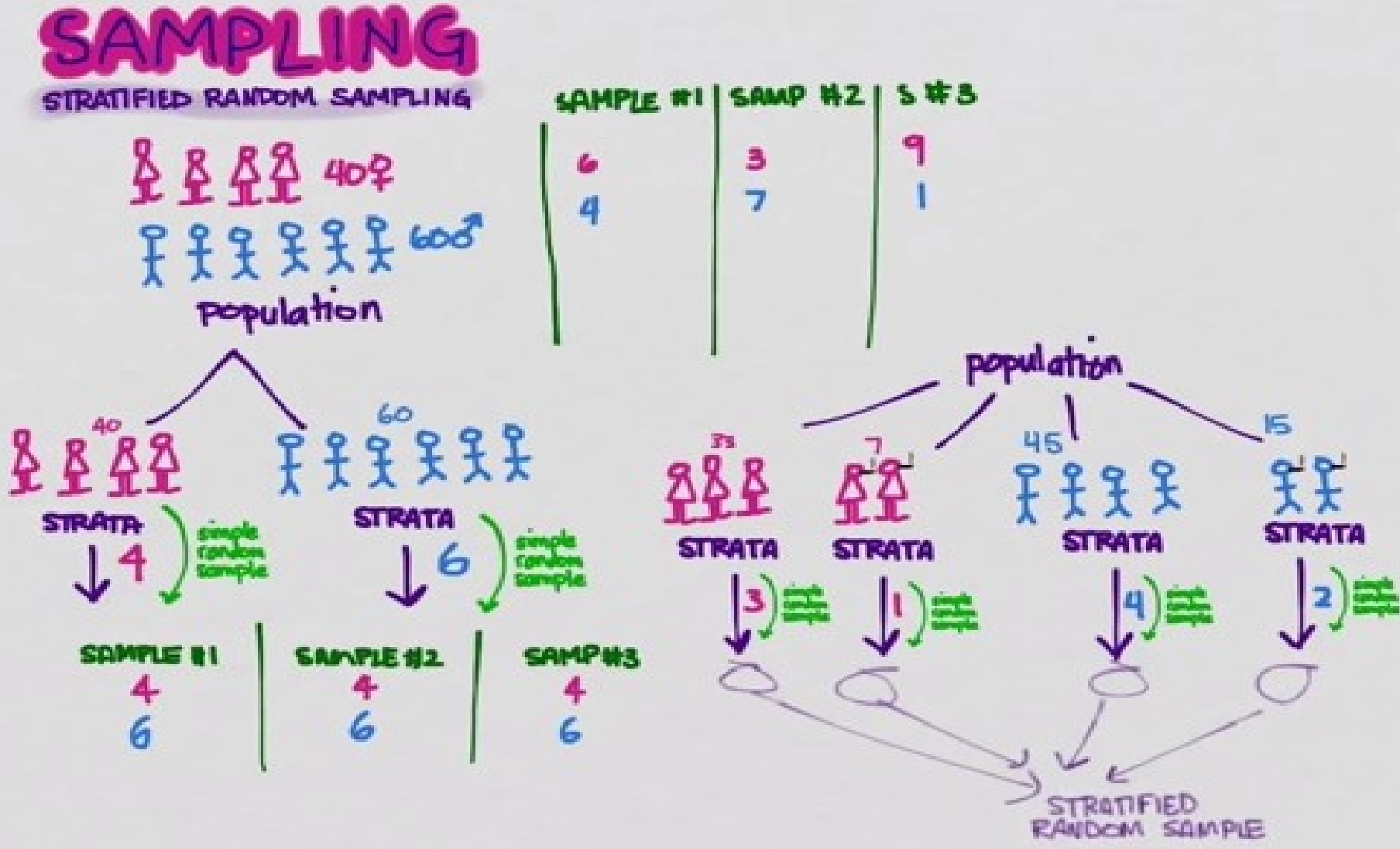
The sample sizes are 20 from A and 30 from B.

units from each institution are to be selected by simple random sampling.

- Example on excel

[Click here](#)

2.5.2 Stratified Random Sampling:



2.5.3 Systematic Sampling:

- This method is widely employed because of its ease and convenience. A frequently used method of sampling when a complete list of the population is available is **systematic sampling**.

Assignment

- Prepare a paper to list What are the merits and limitations of each type of sampling with presentation

Exercise

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