# 1. Introduction

Welcome to the series of E-learning modules on Advantages of Sampling Vis-à-vis Complete Enumeration. In this module, we are going to cover the typical problems in sampling, sampling bias, selection and nonresponsive error, errors due to sampling frame and the possible remedial actions.

By the end of this session, you will be able to:

- Explain Complete Enumeration Survey
- Explain Sample Survey
- Explain the merits and demerits of Complete Enumeration Survey
- Explain the merits of Sample Survey
- Describe the need for Sample Survey

In the present era of competitive globalization, the government of any country requires detailed information about the requirements of the people, the production in the country, the recourses available etc. to frame its policies in all fields.

Such data is also very important for industrial organization to plan their production, expansion of activities, sales organization etc. The collection of data is an activity of major importance in the life of a nation.

Information about the population can be collected in two ways:

- 1) Census Method
- 2) Sample Survey

Let us now discuss about the Census method which is also known as Complete Enumeration Survey.

Census survey is a statistical survey, which makes use of whole population. Under census or Complete Enumeration Survey method, data are collected for each and every unit (like person, household, field, shop etc. as the case may be) of the population or Universe.

For example: If the average wage of workers working in a sugar industry in India is to be calculated. The wage figures are obtained from each and every worker working in the sugar industry and the average wage figure is obtained. In this way, Census method is an intensive study.

Some of the merits of Census Survey are as follows:

- Results are more reliable: Since data are obtained from each and every unit of the population, the investigation made is more true and reliable, because every item is enquired. These results are therefore more likely to be accurate and reliable.
- Intensive study: The investigation helps in bringing out some rare phenomenon. Many facts of a problem may be brought to light.
- Wide Use: The data collected in this method has wide acceptance and has a wide purview so that the data collected has many facets so it can be used in more than one

problem studies.

Diverse units: The method is of immense use when the various units of the universe are of diverse characteristics.

Even though the Census Survey is more reliable and leads to intensive study, census method is not very commonly used in practice which is probably because of the following demerits:

- Costly Method: It is a costly method and requires big organizations to handle the process accurately. This is the reason, why Government alone uses this method for conducting population surveys, production, livestock, land holdings census etc.
- Huge time and labour required: The time and labour required by this method of data collection is immense.
- Difficult to enquire: When the population is infinite or extremely complex, it is difficult to enquire about each and every item of the universe.
- Destruction of units: Sometimes the process of evaluation itself involves destruction of the units.

## 2. Sample Survey

Now we will discuss about the Sample Survey.

Sampling is simply the process of learning about the population on the basis of a sample. A sample is a part of the population, which is selected for the purpose of investigation. It is the one, which should exhibit the characteristics of the universe.

Thus, in the sampling technique instead of each and every unit of the population only a part of the universe is studied and the conclusions are drawn on that basis for the entire universe.

If it is not essential to conduct the complete enumeration, then a sample of some suitable size is selected from the population and the study is carried out on that sample. This study is called sample survey.

Most of the research work is done through sample surveys. The opinion of the voters in favour of certain proposed election candidates is obtained through sample survey.

With large population and multiplication of activities in almost all fields the collection of information from each unit of a population say from each farm, each household, each factory is simply out of question. The financial outlay and time required for such a program will be very disproportionate to the utility of the final result when available.

The only course open is to collect data from a small part of the population and obtain information about the population on the basis of this data.

According to A. C. Rosander, the sample has many advantages over the census or complete enumeration. It is carefully designed. The sample is not only considerably cheaper but may give results which are just accurate and sometimes more accurate

than those of a census. Hence, a carefully designed sample may actually be better than a poorly planned and executed census.

Sampling has several merits over the complete count. They are:

- 1) Sample survey is cheaper than a Census survey: The total financial burden of a sample survey is less than that of a complete enumeration survey.
- 2) Sample survey requires less time and labour: Sampling involves a study of the part of the population where considerable amount of time and labour is saved not only in collection of data but also in processing it. Hence, sample survey provides timely data.
- 3) Well executed sample surveys provide accurate results than census surveys: If sampling is carried out properly it can provide more reliable information than census method. This is because:

(i) It is always possible to determine the extent of sampling errors

(ii) Other types of errors to which survey is subjected such as inaccuracy, incompleteness of returns etc.

- (iii) Follow up work can also be undertaken effectively in the sampling method.
- 4) Sample survey is more scientific in nature.
- 5) Great scope: There is a greater scope in a sample survey than a census survey. Since sampling techniques saves time and money it is possible to collect more detailed information in a sample survey.
- 6) In a sample survey (generally), sampling errors can be reduced by adopting proper techniques.
- 7) A sample survey generally gives the data of better quality than a census survey.

### 3. Need of Sampling – Part 1

Let us now discuss the need for Sampling.

Sometimes there is a need for sampling. Suppose we want to inspect the eggs, the bullets, the missiles and the tires of some firm. The study may be such that the objects are destroyed during the process of inspection. Obviously, we cannot afford to destroy all the eggs and the bullets etc.

We have to take care that the wastage should be minimum. This is possible only in sample study. Thus, sampling is essential when the units under study are destroyed. Sampling remains the only choice when the test involves the destruction of the item under study.

#### 1. Save Time and Cost

As the size of the sample is small as compared to the population, the time and cost involved on sample study are much less, than the complete counts. For complete count, huge funds are required. There is always a problem of finances. A small sample can be studied in a limited time and total cost of sample study is very small. For complete count, we need a big team of supervisors and enumeration who are to be trained and they are to be paid properly for the work they do.

Thus, the sample study requires less time and less cost. Time is saved not only in the collection of data but also in processing it. For these reasons sample survey provides timely data. However, the amount of effort and expenses involved in collecting the information may be greater per unit of the sample than the complete Census.

**For example:** For the government by-census (note: population census is usually conducted once every ten years and a by-census is conducted in the middle of the inter censal period), one fifth of the population is large enough to declare what the government wants to know. There is no need to spend several times or money to interview the entire population in the society.

The costs on sampling should be much lower than that on census. The speed of execution reduces the time between the recognition of a need for information and the availability of that information. This is a vital consideration when the information is urgently needed. Hence, sampling can save the time.

In United States the most important recurrent surveys taken by the government are to use samples of around one lakh five thousand persons or about one person in one thousand two hundred and forty. Surveys used to provide facts bearing on sales and advertising policy in market research may employ sample of only few thousands.

#### 2. Reliability

If we collect the information about all the units of population, the collected information may be true. However, we are never sure about it. We do not know whether the information is true or is completely false. Thus, we cannot say anything with confidence about the quality of reliability is information. We sav that the not possible. This is а verv important advantage of sampling. The inference about the population parameters is possible only when the sample data is collected from the selected sample.

If sampling carries out properly, it can provide more reliable information than census method. This is because:

- $\square \square \square$  It is always possible to determine the extent of sampling errors
- Consult of the survey of errors to which a survey is subject such as inaccuracy of information, incompleteness of returns etc., are likely to be more serious in complete census than in a sample survey. This is because more effective precautions can be taken in a sample survey to ensure that the information is accurate and complete.
- It is possible to avail the services of experts and impart thorough training to the investigators in a sample survey which further reduces the possibility of errors

Follow-up work can also be undertaken effectively in the sampling method

Sometimes the experiments are done on sample basis. The fertilizers, the seeds and the medicines are initially tested on samples and if found useful, then they are applied on large scale. Most of the research work is done on the samples.

3. Sample data is also used to check the accuracy of the census data.

## 4. Need of Sampling – Part 2

4. Inapplicability of the Census:

Sometimes the method of evaluation is such that census method of data collection is absolutely impossible. If the population is hypothetical as for example in a coin tossing problem the process may continue indefinitely (any number of times). In such cases, sampling method is the only scientific method, which can be used for estimating the parameters of the Universe. Moreover, if population or Universe is infinite, sampling is the only possible solution. Hence, Sample Survey remains the only way when the population is hypothetical and consists of infinitely many members.

5. More details:

Since sampling techniques saves time and money it is possible to collect more detailed information in a Sample Survey. For example: Instead of collecting one information from the whole Universe say of thousand people, if we collect more information from ten of the Universe, that is from hundred people, we tend to collect and gain more knowledge about the universe with lesser cost, time and labour involved.

6. A Greater quality:

The quality of a study of a population was often better with sampling than with a census. Sampling possesses the possibility of better interviewing (testing), more thorough investigation of missing, wrong, or suspicious information, better supervision, and better processing than is possible with complete coverage. Research findings substantiate this opinion. More than ninety percent of survey error in one study was from non-sampling error one, and ten percent or less was from sampling error two.

Personnel of higher quality can be employed and given intensive training. Because of more

careful supervision of the field work, processing of the results becomes feasible when volume of work is reduced. A sample may produce more accurate results than the kind of complete enumeration that can be taken.

7. Greater scope:

In certain types of enquiry highly trained personnel or specialized equipment limited in availability must be used to obtain the data. Thus, surveys that rely on sampling have more scope and flexibility regarding the types of information that can be obtained. On the other hand, if accurate information is wanted for many subdivisions of the population the size of the sample needs to do the job which is sometimes so large that a complete enumeration offers a best solution.

We can collect information from the Universe either by enumerating each and every unit of the Universe what we call as Census Survey or by enumerating a representative portion of the population what is known as Sample Survey.

Hence, in a Census Survey all the units are taken into account whereas in a Sample Survey only a few selected items are studied and on the basis of such studies attempts are made to draw generalization which may be applied to the whole data.

If the scope of the enquiry is very wide the census enquiry will not only be very expensive but will be highly cumbersome also. In such cases sample investigation is very suitable. A sample usually gives representative data and the generalization made on the basis of such data usually hold good for the Universe. Sampling usually enables to estimate sampling errors and thus assists in obtaining information concerning some characteristics of the population.

### 5. Uses of Sample Survey & It's Classification

Let us now discuss why Sample Survey are used.

- Pool of possible cases is too large (e.g., two hundred and sixty million Americans) -would cost too much and take too long
- Don't want to use up the cases
- It's not necessary to survey all cases: for most purposes, taking a sample yields estimates that are accurate enough
- The trade-off is that where sampling introduce some error. You didn't interview everybody, so certain opinions or combinations of opinions would not be represented in your data. When the population is very diverse, your sample can't include all the possible combinations of attributes that are found in the population. Such as blacks and whites, men and women, cardiac patients, non-patients, black women, white men with heart trouble.

Sampling has come to play a prominent part in national decennial census. In the United States a five percent sample was introduced into the nineteen forty census by asking extra questions about occupation, parentage, fertility and the like of those persons whose names fell on two of the forty lines on each page of the schedule. This use of sampling was greatly extended in nineteen fifty.

From a twenty percent sample (every fifth line) information was obtained on items such as income, years in alcohol, migration and service in armed forces. Sampling was also used to speed up the publication of results. This process continued in the nineteen sixty and nineteen seventy censuses. Except for some basic information required from every person for constitutional or legal reasons, the whole census was shifted to sample basis.

In addition to their use in census, continuing samples are employed by government bureaus to obtain current information. In the Unites States, examples are the current population survey, which provides monthly data on the size and composition of the labour force and on the number of unemployed.

On smaller scale local governments – city, state and country are making increased use of sample surveys to obtain information needed for future planning and for meeting the pressing problems.

Market research is heavily dependent on sampling approach to get the estimates of the sizes of television and radio audiences for different programme and newspaper and magazine readership is kept continuously under scrutiny.

Business and industry have many uses of sampling in attempting to increase the efficiency of their internal operations. The important areas of quality control and acceptance sampling where the decisions taken with respect of level or change of quality or to acceptance or rejection of batches are well grounded only if the results obtained from the sample data are valid for the whole batch.

Sample survey can be classified broadly into two types descriptive and analytical.

In descriptive survey the objective is to obtain certain information about the large groups. For example: Numbers of men, women, and children who view a television program.

In an analytical survey the comparisons are made between two different subgroups of the population. In order to discover whether the difference exist among them and to form or verify hypothesis about the reasons for these differences.

For example: The fertility survey for instance was an attempt to determine the extent to which the married couples plan the number and spacing of children, the husband and wife's attitude towards this planning and the degree of success obtained.

Of course the distinction between descriptive and analytical survey is not clear. Many surveys provide data that serve both purposes. Along with the rise in the number of descriptive surveys there has been noticeable increase in surveys taken primarily for analytical purposes, particularly in the study of human behaviour and health.

Our knowledge, our attitudes and our actions are based on a very large extent of samples. This is equally true in everyday life and in scientific research. Travellers, who spend just ten days in a foreign country and then proceed to write a book which tells the citizens about how to revive their industries, reform their political system, balance their budget etc.

According to Prof R. A. Fisher (Nineteen Fifty) in a report of "The sub commission on Statistical Sampling of the United Nations" sums the advantages of sampling techniques over complete census in the following four words: Adaptability, Speed, Economy and Scientific Approach.

Here's a summary of our learning in this session where we have understood:

- The Census Survey
- Merits and demerits of Census Survey
- The Sample Survey
- Merits of Sample Survey
- Need of Sample Survey
- Uses of Sample Survey