THEORY OF SAMPLING

Dr. SANJEEV KUMAR, Department of Economics, Chaudhary Charan Singh University, Meerut

Meaning: In simple words sampling consists of obtaining information from a larger group or a universe.

A social researcher has to collect information about a universe that consists of vast, differentiated population spread over a large territory and that too with in a limited amount of time and money.
Measuring or collecting information from each and every member of such a vast population is, therefore, always not possible. It is known that part of a whole can give sufficient dependable information if the procedures followed in collection the part has of been scientific.

What should be the desired characteristics of a Sample?

- A proper sample must give a precise but correct picture of the population from which it is drawn.
- The sample must be obtained by probability process. This would permit the use of statistical procedures to describe and analyze the sample data.
- The sample should be as small as precision considerations permit
- It should be as economical as possible and gathered swiftly to be completed within the time schedule.

Concepts used in Samplings

The following concepts are used in sampling designs

- Universe or population
- Stratum
- Elements, and
- Sample

Universe

In sample language, a population or universe can be defined as any collection of persons or objects or event in which one is interested.
In other words a population consists of the people who are related to the specific problem under investigation.
For example, if we are studying the relationship between the class achievements of the university students and the methods of teaching then the students of any place and of any time will come under our population.
If we are studying the voting behaviour or political participation of the citizens of India then all the adult citizens of India, living in India or outside will come under population.

Population Characteristics

In research, we often speak in terms of population characteristics. e.g. age, sex, income, place of residences, caste, occupation population, size, denote etc. at the same time all of these characteristics are measured.
What characteristics are to be measured depends upon the nature and type of problem under investigation.

Types of Universe

The universe, on the basis of characteristics, could be divided in to three types.

- Univariate population
- Bi-variate population
- Multivariate population

Univariate population

In which only one characteristic is considered, for studying at a time. The characteristic may be age, income, sex, T.V. listening habit, etc.

Bi-Variate Population

The population can be defined as a bivariate type when we are measuring two characteristics simultaneously of each member. In sociology we often get interested to know how characteristics are related to each other or are associated with each other. For example, we want to know how crime going habit varies from urbanites to ruralities or how political participation is determined by degree of political awareness etc.

Multivariate Universe

A multivariate universe is the one in which we consider observations on three or more characteristics simultaneously. Several social factors together determine the occurrence of an event. e.g. a car accident on the road is often caused not only by the mechanical factor of the car but also by the other factors like, the drivers mental and physical condition, traffic volume, improper signals at crossing, pedestrians behaviour etc. similarly poverty is caused by several factors like big and fast growing population lack of proper industrialization according to the growing need of the population, discriminate distribution of wealth, etc.

Stratum

When the population is divided into several groups on the basis of one or several characteristics, we call each group as a stratum. Stratum can also be called as a sub population. A stratum may be defined by one or more specifications that divide a population into mutually exclusive segments.
e.g. a given population may be divided into different stratums on the basis of the cinema going habit of the people viz. (a) males who visit cinema frequently,(b) males who rarely visit cinema; (c) males who visit cinema occasionally; (d) males who do not at all visit cinema. Thus the number of stratums would depend upon the number of characteristics included for stratification.

Population Element

By a population element we mean the units that make the population. Such units may be an individual, an object, or even a small group.

Sample

By sample we mean the aggregate of objects, persons or elements, selected from the universe. It is a portion or sub part of the total population.
The following two methods are used to collect information about the population

- Census and;
- Sampling

Census: When each and every element or unit of the population is studied

Sampling: When a small part of the population is selected for study.

Why Sampling?

Advantages

- Helps to collect vital information more quickly. Even small samples, when properly selected, help to make estimates of the characteristics of the population in a shorter time.
- The modern world is highly dynamic, therefore, any study must be completed in short time, otherwise, by the time the survey is completed the situations, characteristics etc may have changed.
- It cuts costs; enumeration of total population is much more costly than the sample studies.
- Sampling techniques often increases the accuracy of data. With small sample, it becomes easier to check the accuracy of the data. Some sampling techniques/ methods make it possible to measure the reliability of the sample estimates from the sample itself.
- From the administrative point of view also sampling becomes easier, because it involves less staff, equipments etc.

Disadvantages

- Sampling is not feasible where knowledge about each element or unit or a statistical universe is needed.
- The sampling procedures must be correctly designed and followed otherwise, what we call as wild sample, would crop up with mis-leading results.
- Each type of sampling has got its own limitations.

- There are numerous situations in which units, to be measured, are highly variable. Here a very large sample is required in order to yield enough cases for achieving statistically reliable information.
- To know certain population characteristics like population growth rate, population density etc. census of population at regular intervals is more appropriate than studying by sampling.

Techniques of Sampling

- Probability Sampling Techniques
- Non Probability Sampling

Probability Sampling Techniques

A probability sampling technique is one in which one can specify for each element of population, the probability of its being included in the sample. Every probability can be expressed in the form of a proportion e.g. the probability of getting a head in testing a coin is 1/2 or 1 chance in 2 trials. Thus, probability samples are characteristised by the fact that the probability of selection of each unit is known.
In the sample of example each of the elements has the same probability of being included as in random sampling method. An essential quality of a probability sample is that it makes possible representative sampling plans. It also provides an estimate of the extent to which the sample characteristics or findings are likely to differ from the total population.

Major Forms of Probability Sampling Methods are:

- Simple random sampling method, and
- Stratified random sampling method

Non Probability Sampling

In non probability sampling techniques one cannot estimate before hand the probability of each element being included in the sample. It does not also assure that every element has a chance of being included.
In probability sampling, one has to prepare or know atleast all the elements of the total population from which the sample is to be drawn. This makes the sampling procedure costlier and more time consuming.
The major forms of non probability samples are:

- Accidental samples
- Quota samples, and;
- Purposive samples

Types of Probability Sampling

Simple Random Sampling Method
In a day to day business, the term random is frequently used for careless, unpremeditated, casual haphazard activity or process. Which means that a random samples is drawn carelessly in unplanned manner, without a definite aim or deliberate purpose. This concept is not correct. Random sampling correctly means the arranging of conditions in such a manner that every item of the whole universe from which we are to select the sample shall have the same chance of being selected as any other item.
Random sampling, therefore, involves careful planning and orderly procedure.

Steps of Simple Random Sampling

- Involves listing or cataloguing of all the elements in the population and assigning them consecutive numbers.
- Deciding upon the desired sample size.
- Using any method of sampling, a certain number of elements from the list is selected.

Advantages of Random Sampling Technique

- Most basic, simple and easy method
- Provides a representative sample.

Disadvantages

- In most cases it is difficult to find data list of all units of the population to be sampled.
- The task of numbering every unit before the sample is chosen is time consuming and expensive.

- The units need not only to be numbered but also arranged in a specified order.

- The possibility of obtaining a poor or misleading sample is always present when random selection is used.

Methods of Drawing, Sample in Random Method

Lottery Method: The numbers of all the elements of the universe are written on different tickets or pieces of paper of equal size shape and colour. which are then shuffled thoroughly in a box, or a container. Then tickets are then drawn randomly their numbers are noted and the corresponding individuals or objects are studied.

Tippets Numbers: It was first developed by Prof L. H. C. Tippet and since then is known by his name. He developed a list of 10,400 sets of numbers randomly, each set being of four digits There numbers are written on several pages in unsystematic order.

Grid Method: This method is applied in selection of the areas. Suppose we have to select any number of areas from a town or any number of towns from a province for survey. For selection, first a map of the whole area is prepared. The area is often divided into different blocks. A transparent plate is made equivalent to the size of the map that consists of several seqared holes in it which carries different numbers. By random sampling method it is decided as to which numbers are to be included in the sample.

Systematic Sampling Method

In this method first of all a list is prepared of all the elements of the universe on the basis of a selection criterion. A list may be prepared in alphabetical order, as given in the telephone directory. Then from the list every third, every tenth every twentieth or any number in the like manner can be selected. For the application of this method, preparing a list of all the elements and numbering them is essential. Secondly, the population needs to be homogenous in nature. Social phenomenon is variable in nature and individuals are heterogeneous. However on their social characteristics they are homogenous viz. we may decide to cover only the students, the professors, the slum dwellers etc. The characteristics to be selected for this purpose must be relevant to the problem under study.

Advantages

- It is frequently used because it is simple, direct and in- expensive.
- When a list of names or items is available, systematic sampling is often an efficient approach.

Disadvantages

- One should not use systematic sampling in case of exploring unfamiliar areas because listing of elements is not possible
- When there is a periodic fluctuation in the characteristic under examination in relation to the order in which the items appear, the methods is ineffective

Stratified Random Sampling Method

Definition: When the population is divided into different strata or groups and then samples are selected from each stratum by simple random sampling procedure or by regular interval method, we call it as stratified random sampling method. According to the nature of the problem relevant criteria are selected for stratification. Among the possible stratifying criteria, cum age, sex, family income, number of years of education, occupation, religion, race, place of residence etc. On the basis of characteristics universe can be divided into different strata or stratum, Each stratum has to be homogeneous from within such a division can be done on the basis of any single criterion. e.g. on the basis of age we can divide people into below 25 and above 25 groups, on the basis of education into matriculates and non matriculates etc. Stratification can also be done on the basis of a combination of any two or more criteria viz. on the basis of sex and education, we can divide the people into four groups.

- Educated women
- Un-educated women
- Education men
- Un educated men

Elements are then selected from each stratum through simple a random sampling method. An estimate is made for each stratum separately. These estimates are combined to provide an estimate for the entire population.

Purpose: The primary purpose is to increase the representatives of the sample without increasing the size of the sample on the basis of having greater knowledge of the population characteristics.

Advantages

- The population is first stratified into different groups and then the elements of the sample are selected from each group. Therefore, the different groups are sure to have representation in the sample. In case of random sample, there is possibility that bigger groups have greater representation and the smaller groups are often eliminated or under represented.
- With more homogenous population greater precision can be achieved with fewer cases. This saves time in collecting and processing of the data when detailed study about population characteristics are wanted it is more effective.
- As compared to random samples, stratified samples are geographically more concentrated and thus save time, money and energy, in money from one address to another.

Disadvantages

- Unless there are extreme differences between the strata, the expected proportional representation would be small. Here a random sampling may give a nearly proportional representation.
- Even after stratification, the sample is selected from each stratum either by simple random sampling method or by systematic sampling method; as such the draw backs of both methods can be present.
- For application of the stratified method, one must know the characteristics of the specified population in which the study is to be made. He must also known as to which characteristics are related to the subject under investigation and therefore can be considered as relevant for stratification.
- The process of stratification becomes more and more complicated and difficult as the numbers of characteristics to be used for stratification are increased.

Types of Stratified Sampling

Stratified random sampling method can further be sub divided into two groups

- Disproportionate stratified sampling
- Proportionate stratified sampling

Disproportionate stratified sampling: Disproportionate stratified sampling is also known as equal size stratified sampling. In this method, an "equal number" of cases are selected from each stratum irrespective of the size of the stratum in the universe. The number of cases drawn from each one is restricted to the number of pre designated in the plans. This also called "controlled sampling" because the number of cases to be selected in various strata us limited.

Advantages

- When equal numbers of cases are taken from each stratum, comparisons of different strata are facilitated.
- Economy of procedure
- The controlled sample prevents the investigators from securing an un necessary large number of schedules for most prevalent groups of population.

Disadvantages

- It requires the weighing of results stratum by stratum, the relative frequency of each stratum in the universe must be known or estimated in under tto determine the weights.

Proportionate stratified Sampling: In this method cases are drawn from each stratum in same proportion as they occur in the universe. To apply this method we first of all we need to have a list of all striatum and also need to know their proportionate size in total population. Since the size of the stratum vary, the number of persons coming from each stratum in the sample on the basis of selection of a given percentage of people will also vary.

Advantage

- The definiteness of proportional representation.

Disadvantage

- ❖ The researcher may have poor judgment or in adequate information upon which to base the stratification. the greater the number of characteristics on which we are to boor our stratification, and the more are the strata the more complicated becomes the problem of securing proportional representation of each stratum.

Cluster Sampling

In cluster sampling the stratification is done in a manner that the groups are heterogeneous in nature rather than homogenous. Here the elements are not selected from each stratum as is done in stratified sampling, rather the elements are obtained by taking a sample of group and not from within groups. That means that out of several clusters or groups, one, two or more number of clusters are selected by simple or stratified random method and their elements are studied.
All the elements in these clusters are not to be included in the sample; the ultimate selection from within the clusters is also carried out on simple or stratified sampling basis.
Purpose: The purpose of a cluster sample is to reduce cost and not essentially to increase percussion.
Advantage

- ❖ In cluster sampling the cost per element is greatly reduced.
- ❖ It becomes possible to take a larger sample and regain the amount of precision
- ❖ It can be used in situations where it is impossible to obtain sample by other methods.

Disadvantage

- ❖ It is a complicated sample design the researcher has to be highly skilled in sampling.
- ❖ Its standard errors are almost inevitably larger then those of sample random sampling.

Multi-stage sampling

The method is used in selecting a sample from a very large area. As the name suggests m.s. sampling refers to a sampling technique which is carried out in various stages. Normally a multi-stage sampling is the one that combines cluster and random sampling methods.
Eg., if we want to study the socio-economic background, attitudes and motivations of slum dwellers, we can first make a list of the cities which would thus make our clusters.
From these clusters we can select any number of cities. Then each city or cluster would be stratified into different slum areas. Thus our cities can be called as primary sampling units and the slum areas as secondary sampling units.

Non-Probability Sampling

Non probability sampling is the one in which one cannot estimate before had the probability of each element being included in the sample.
The major forms of non-probability samples are;

- ❖ Accidental samples
- ❖ Quota samples and
- ❖ Purposive samples

Accidental Samples: Accidental sampling means selecting the units on the basis of easy approaches. Here one selects the sample that fall to hand easily.
E.g. suppose one is studying the political socialization and political participation among university and college students of A.U. and his sample size is 100.
He would go to the university campus and would select the first hundred students whom he happens to meet, whether in class room, or in students common room or in field. Such type of sampling is easy to do and saves time and money. But the chores of bias are also great.

Quota Sampling

In quota sampling the interviewers are interested to interview a specified number of persons from each category. The required numbers of elements from each category are determined in the office ahead of time according to the number of elements in each category. Thus an interviewer would need to contact a specified number of men and specified number of women, from different age categories from different religious or

social groups etc. The basis purpose of quota sampling is the selection of a sample that no true replace of the population about which one wants to generalize.

Advantage

- If properly planned and executed, a quota sample is most likely to give maximum representative sample of the population.

- In purposive sampling one picks up the cases that are considered to be typical of the population in which to one is interested.
- The cases are judged to be typical on the basis of the need of the researcher.
- Since the selection of elements is based upon the judgment of the researcher, the purposive sampling as called judgment sample.
- The researcher trees in his sample to match the universe in some of the important known characteristics.

Disadvantage

- The defect with this method is that the researcher can easily make esser in judging as to which cases are typical.

Purposive Sampling

"Deliberate Sampling" or "Judgment Sampling".

- When the researcher deliberately selects certain units from the universe, it is known as purposive sampling.
- However, it must be kept in mind that the units selected must be representative of the universe.
- That, the names may be selected from a Telephone Diretory, Automobile Registration Records (RTOs) etc.

Advantage

- Quote sampling is a stratified cum purposive sampling and thus enjoys the benefits of both samplings.
- It proper controls or checks are imposed, it is likely to give accurate results.
- It is only useful method when no sample frame is available.

Convenience Sampling

It is known as unsystematic, careless, accidental or opportunistic sampling. Under this a sample is selected according to the convenience of the investigator.

May be use when

- Universe is not clearly defined
- Sampling units are not clear
- Complete source list is not available

SAMPLING: THEORETICAL BASIS

Theoretical Basis of Sampling

- On the basis of sample study we can predict and generalise the behaviour of mass phenomenon.
- This is possible because there is no statistical population whose elements would vary from each along without limit.
- Though we final diversity is a universal quality of mass data, every population has characteristic properties with limited variation.
- Thus makes possible to select a relatively small unbiased random sample that can portray fairly well.

There are two important laws on which the theory of sampling is based:

- Law of 'statistical Regularity' , and;
- Law of 'Inertia of Large Number'.

Law of 'Statistical Regularity'

This law says that if a sample is taken, at random, from a population, it is likely to possess almost the same characteristics as that of the population. The size of sample should be 'moderately large'.

Law of Inertia of Large Number

This law is a corollary (result or supplement) of the law of statistical regularity. It states that if other things being equal, larger the size of the sample, more accurate the results are likely to be. Thus is because large numbers are more stable as compared to small ones. The difference in the aggregate result is likely to be significant, when the number in the sample is large.

Essentials of Sampling

If the sample results are to have any worthwhile meaning, it should possess the following essentials.

- **Representativeness:** A sample should be so selected that it truly represents the universe, otherwise the results obtained may be misleading.
- **Adequacy:** The size of sample should be adequate otherwise it may not represent the characteristics of the universe.
- **Independence:** All the items of the sample should be selected independently of one another and all the items of the universe should have the same chance of being selected in the sample.
- **Homogeneity:** The term homogeneity means that there is no basic difference in the nature of the universe and that of the sample. It two sample from the same universe are taken, they should give more or less the same unit.

Probability Sampling Methods

Simple or un restricted Random Sampling: Simple random sampling refers to that sampling technique in which each and every unit of the population has an equal opportunity of being selected in the sample. In simple sampling which item gets selected in the sample is just a matter of chance personal bias of the investigator does not influence the selection. It must be noted that random does not mean 'haphazard' or 'hit-or-miss' - it rather means that the selection process is such that chance only determines which items shall be included in the sample.

Lottery Method: This is a very popular method of taking a random sample under this method, all items of the universe are numbered or named on a separate steps of paper of identical shape and size. These slips are then folded and mixed up in a container or drum. A blind fold selection is then made of the number of slip required to constitute the desired sample size. The selection of items is thus depends entirely on chance.

Restricted Random Sampling

Stratified Sampling: Stratified random sampling or simply stratified sampling is one of the random methods which, by using the available information concerning the population, attempts to design a more efficient sample than obtained by simple random procedure.

Proportionate and Disproportionate Stratified Sample: In a proportionate stratified sampling plan, the number of items drawn from each strata is proportional to the size of strata. For example, if the population is divided into five strata groups, their respective sizes being 10, 15, 20, 30 and 25 percent of the population and a sample of 5,000 is drawn. The desired proportional sample may be obtained as follows:

From stratum one	5,000 (0.10) = 500 items
From stratum two	5,000 (0.15) = 750 items
From stratum three	5,000 (0.20) = 1,000 items
From stratum four	5,000 (0.30) = 1,500 items
From stratum five	5,000 (0.25) = 1,250 items
Total	5,000

Systematic Sampling: A systematic sampling is formed by selecting one unit at random and then selecting additional units at evenly spaced intervals until the sample has been formed.

Thus method is popularly used in those cases where a complete list of the population from which the sample is to be drawn is available. The list may be prepared alphabetically, geographically numerical etc. The items are serially numbered. The first item is selected at random generally by following the lottery method. Subsequent items are selected by taking every the item from the list where 'k' refers to the sampling interval or sampling ratio.

or k ' N / n,

Where N = size of universe

n = size of sample
k = sampling interval

Size of Sample

- An important decision that has to be taken in adopting a sampling technique is about the size of the sample. Size of the sample means the number of sampling units selected from the population to be investigated.
- Different opinions have been expressed by experts on this point. Some suggest that the sample size should be 5 percent of the size of population while others are of the opinion that the sample size should be at least 10 percent. However, these views are of little use in practice because no hard and fast rule can be laid down that sample size should be 5 percent, 10 percent or 25 percent of the universe size.
- It may be provided out that mere size alone does not ensure representativeness. A smaller sample, but well selected sample, may be superior to a larger but badly selected sample. Similarly, if the size of the sample is small, it may not represent the universe and the inference drawn about the universe may be misleading. On the other hand, if the size of sample is very large, it may too burdensome financially, require a lot of time and may have serious problems of managing it.
- Hence the sample size should neither be too small nor too large. It should be optimum. Optimum size is that one that fulfils the requirements of 'efficiency', 'representativeness', 'reliability and 'flexibility'. The following factors should be considered while deciding the size of sample.

The Size of Universe

- The larger the size of universe, the bigger should be the sample size.

The Availability of Resources

- If the resources available are vast, a large sample size could be taken. However, in most cases resources constitute a big constraint on sample size.

Degree of Accuracy or Precision Desired

- The greater the degree of accuracy desired, the larger should be the sample size. However, it does not necessarily mean that bigger samples always ensure greater accuracy. If the sample is selected by experts by following scientific method, it may ensure better results even when it is small compared to a situation in which a large sample size is selected by inexperienced people.

Homogeneity or Heterogeneity of University

- If the universe consists of homogenous units, a small sample may serve the purpose but if the universe consists of heterogeneous units, a large sample may be inevitable.

Nature of Study

- For an intensive and continuous study a small sample may be suitable. But for studies, which are not likely to be repeated and are quite extensive in nature, a large sample size may be required.

Method of Sampling Adopted

- The size of sample is also influenced by the type of sampling plan adopted. For example, if the sample is a simple random sample, it may necessitate a bigger sample size. However, in a properly drawn stratified sampling plan, even a small sample may give a better result.

Nature of Respondent

- Where it is expected that a large number of respondents will not co-operate and send back the questionnaire, a large sample should be selected.

Determination of Sample Size

- A number of formulae have been devised for determining the sample size depending upon the availability of information.

$$n = \left(\frac{Z\,\sigma}{d} \right)^2$$

Where
n = sample size
z = value at a specified level of confidence or desired degree of precision
σ = standard deviation of the population
d = difference between population mean and sample mean.

SAMPLING AND NON SAMPLING ERRORS

- The error assign out due to drawing inferences about population on the basis of few observations (sampling), is termed 'sampling error'.
- In the complete enumeration survey since the whole population is surveyed, sampling error in this sense in non-existent. However, the mainly arising at the stage of ascertainment and processing of data, which are termed non-sampling errors, are common both in complete enumeration and sample surveys.

Sampling Errors: Even if utmost care has been taken in selecting a sample, the results derived from a sample study may not be exactly equal to the true value in the population. The reason is that estimate is based on a part and not on the whole and samples are seldom, if ever, perfect miniature of the population. Hence sampling gives rise to certain errors known as sampling errors. However, the errors can be controlled. The modern sampling theory helps in designing the survey in such a manner that the sampling errors can be made small.
Sampling errors are of two types:

- biased, and
- un-biased

Biased Errors: These errors arise from any bias in selection, estimation, etc. For example, if in place of simple random sampling, deliberate sampling has been used in a particular case some bias is introduced is the result and hence such errors are called sampling errors.
Un-biased Errors: These errors arise due to "chance" differences between the members of the population included in the sample and those not included. An error in statistics is the difference between the value of a statistic and that of the corresponding parameter.

- Thus the total sampling error is made up of errors due to bias, if any and the random sampling error.
- The bias error, forms a constant component of error that does not decrease in large population as the number of sample increases. Such error is also known as cumulative or non-compensating error. The random sampling error, on the other hand, decreases, on an average, as the size of sample increases. Such errors are, therefore, known as non-cumulative or compensating error.

Causes of Bias: Bias may arise due to:

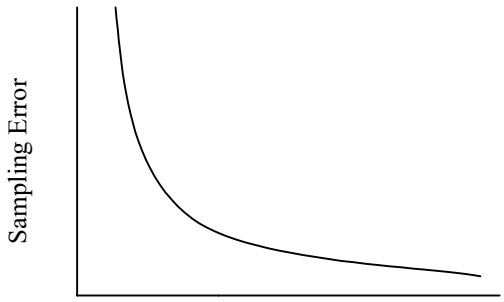
- Faulty process of selection;
- Faulty work during the collection; and
- Faulty methods of analysis

Faulty Selection: Deliberate selection of a 'representative' sample.
Substitution: Substitution of an item in place of one chosen in random sample some times lead to bias.
Non response: It all the items to be included in the sample are not covered then there will be bias even though no substitution has been attempted.
An appeal to the variety of the person questioned may give rise to yet another kind of bias. For example, the question. Are you a good student? is such that most of the students would succumb to variety and answer 'Yes'.
Bias Due to Faulty Collection of Data: Any consistent error in measurement will give rise to bias whether the measurements are carried out on a sample or on all units of the population. The danger of error is, however, likely to be greater in sampling work. Bias may arise due to improper formulation of the decision, problem or strongly defining the population etc. Bias observation may result from poorly designed questionnaire, ill trained interviewer, failure of a respondents memory.

Bias in Analysis: In addition to bias, which arises from faulty process of selection and faulty collection of information, faulty methods of analysis may also introduce such bias. Such bias can be avoided by adopting the proper method of analysis.
Avoidance of Bias: If the possibility of bias exists, fully objective conclusion cannot be drawn. The first essential of any sampling or census procedure must, therefore, be the elimination of all sources of bias.

Method of Reducing Sampling Errors

- Once the absence of bias has been ensured, attention should be given to the random sampling errors. Such errors must be reduced to the minimum so as to attain the desired accuracy.
- Apart from reducing errors of bias, the simplest way of increasing the accuracy of a sample is to increase its size. The sampling error usually decreases with increase in sample size, and infact in many situations the decrease is inversely proportional to the square root of the sample size.



- From this diagram it is clear that though the reduction in sampling error is substantial for initial increases in sample size, it becomes marginal after a certain stage. In other words, considerably greater effort is needed after a certain stage to decrease the sampling error this is the initial instance.
- From this point of view it could be said that there is a strong case for resorting to a sample survey to provide estimates within permissible margins of error instead of a complete enumeration survey.

Non Sampling Errors

As regards non-sampling errors they are likely to be more in case of complete enumeration survey than in case of a sample survey. When a complete enumeration of units in the universe is needs, one would expect that it would give rise to date free from errors. However, in practice it is not so. For example, it is difficult to completely avoid errors of observation or ascertainment. Similarly, in the processing of data, tabulation errors may be committed, affecting the final result. Errors arising in this manner are termed as non-sampling errors. Non-sampling error can occur at every stage of planning and execution of census or survey. Such errors can arise due to a number of causes such as defective methods of data collection, and tabulation, faulty definition, incomplete coverage etc. More specifically, non-sampling errors may arise from one or more of the following factors:
Data specification may be inadequate and inconsistent with respect to the objectives of the study.

- Inaccurate or inappropriate method of interview, observation or measurement with inadequate on ambiguous schedules.
- Lack of trained and experienced investigators.
- Lack of inadequate inspection and supervision of primacy staff.
- Errors due to non-response.
- Errors in data processing operations.
- Errors committed during presentation and printing of tabulated results.

Control of Non Sampling Errors: In some situations the non-sampling errors may be large and deserve greater attention than sampling errors. While, in general, sampling error decrease with increase in sample size, non-sampling error tends to increase with the sample size.

Increase of complete enumeration non-sampling errors and incase of sample surveys both sampling and non-sampling errors require to be controlled and reduced at a level at which their presence does not vitiate the use of final result.

Reliability of Samples: The reliability of samples can be tested in the following ways.

More samples of the same size should be taken from the same universe and their results be compared. If the results are similar, the sample will be reliable.

If the measurements of the universe are known, then they should be compared with the measurements of the sample. In case of similarity of measurements, the sample will be reliable.