

SAMPLING

Well-selected sampling may reflect fairly accurately of the population. For example, with a survey of a sample of voters, one can predict the voting intentions of millions of voters. A specified value of the population, such as average of variance is named parameter; the corresponding value in the sample is termed a statistic. The chief of sampling is to make an inference about an unknown parameter from a measurable sample statistic. A second aim of sampling is to test a statistical hypothesis relating to population. A sample is drawn and the data collected from the sample informants are analysed and on the basis of the result the hypothesis may be accepted or rejected.

Census v/s Sampling:-

The process of designing a field study, among other things, involves a decision to use sampling or not. The researcher must decide whether he should cover all the units or a sample of units. When all the units are studied, such a complete coverage is called a census survey. When only a sample of the universe is studied, the study is called a sample survey. In making this decision of census or sampling, the following factors are considered:

- 1. The size of the population:** If the population to be studied is relatively small, say 50 institutions or 200 employees or 150 households, the investigator may decide to study the entire population. The task is easily manageable and the sampling may not be required. But if the population to be studied is quite large, sampling is warranted. However, the size is a relative matter. Whether a population is large or small depends upon the undertaken and the time and other resources available for it.
- 2. Amount of funds budgeted for the study:-** The decision regarding census or sampling depends upon the budget of the study. Sampling is opted when the amount of money budgeted is smaller than the anticipated cost of census survey.
- 3. Facilities:-** The extent of facilities available—staff access to computer facility and accessibility to population elements – is another factor to be considered in deciding

to sample or not, when the availability of these facilities is extensive, census survey may be manageable. Otherwise, sampling is preferable.

4. Time:- The time limit within which the study should be completed is another important factor, to be considered in deciding the question of census or sample survey. This, in fact, is a primary reason for using sampling by academic and marketing researchers.

2. CHARACTERISTICS OF GOOD SAMPLE:

Whether the results obtained from a sample survey would be accurate or not depends upon the quality of the sample. The characteristics of a good sample are described below:

1 Representativeness: - A sample must be representative of the population.

Probability sampling techniques yield representative samples. In measurement terms, the sample must be valid. The validity of a sample depends upon its accuracy and precision.

2. Accuracy: - Accuracy is defined as the degree to which bias is absent from the sample. An accurate (unbiased) sample is one which exactly represents the population. It is free from any influence that causes any difference between sample value and population value (say, average).

3. Precision:- The sample must yield a precise estimate. Precision is measured by the standard error or standard deviation of the sample estimate. The smaller the standard error or estimate, the higher is the precision of the sample.

4. Size:- A good sample must be adequate in size in order to be reliable. (For a detailed discussion of sample size) The sample should be of such size that the inferences drawn from the sample are accurate to the given level of confidence.

BASIS OF SAMPLING: Sampling is based on two premises. They are:

1. There is such similarity among the elements in a population that a few of these elements will adequately represent the 85 characteristics of the total population. For example, the attitude of postgraduate students towards the examination system can be

gauged by studying the attitudes of a few representative postgraduate students in a university.

2. While the sample value (statistic) or some sample units may be more than the population value (parameter), the sample value of other sample units may be less than the population value. When the sample is drawn properly these differences tend to counteract each other with the result a sample value is generally close to the population value.

ADVANTAGES OF SAMPLING

- First, sampling reduces the time and cost and research studies. Thanks to the use of sampling, it has become possible to undertake even national or global studies at reasonable cost and time. Such economy in time and cost improves the viability of several field studies like credit surveys, poverty surveys and marketing surveys.
- Second, sampling saves labour. Smaller staffs are required both for fieldwork and for processing and analyzing the data.
- Third, the quality of a study is often better with sampling than with a complete coverage. The possibility of better interviewing, more thorough investigation of missing, wrong or suspicious information, better supervision, and better processing is greater in sampling than in complete coverage. No wonder that the accuracy of decennial population censuses in USA, India and other countries is checked by making sample surveys.
- Fourth, sampling provides much quicker results than does a census. The speed of execution minimizes the time between the recognition of a need for information and the availability of that information. The speed of execution is vital in feasibility studies, evaluation studies and business research. Timely execution of a study is essential for making use of its findings.
- Fifth, sampling is the only procedure possible, if the population is infinite e.g. throws of dice consumer behaviour surveys, etc.

- Last, statistical sampling yields a crucial advantage over any other way of choosing a part of the population for a study. That is when the estimated of the population characteristics are made from the sample results, the precision of these estimates can also be gauged from the sample results themselves .

LIMITATIONS OF SAMPLING

Sampling is however not free from limitations :

1. Sampling demands a through knowledge of sampling methods and procedures and an exercise of greater care: otherwise the results obtained may be incorrect or misleading.
2. When the characteristic to be measured occurs only rarely in the population, a very large sample is required to secure units that will give reliable information about it. A large sample has all the drawbacks of a census survey.
3. A complicated sampling plan may require more labour than a complete coverage.
4. It may not be possible to ensure the representatives of the sample even by the most perfect sampling procedures. Therefore sampling results in a certain degree of sampling errors i.e. there will be some difference between the sample value and the population value.

SAMPLING TECHNIQUES:

If money, time, trained manpower and other resources were not a concern, the researcher could get most accurate data from surveying the entire population of interest. Since most often the resources are scarce, the researcher is forced to go for sampling. But the real purpose of the survey is to know the characteristics of the population. Then the question is with what level of confidence will the researcher be able to say that the characteristics of a sample represent the entire population. Using a combination of tasks of hypotheses and unbiased sampling methods, the researcher can collect data that actually represents the characteristics of the entire population from which the sample was taken. To ensure a high level of confidence that the sample represents the

population it is necessary that the sample is unbiased and sufficiently large. It was scientifically proved that if we increase the sample size we shall be that much closer to the characteristics of the population. Ultimately, if we cover each and every unit of the population, the characteristics of the sample will be equal to the characteristics of the population. That is why in a census there is no sampling error. Thus, “generally speaking, the larger the sample size, the less sampling error we have.” The statistical meaning of bias is error. The sample must be error free to make it an unbiased sample. In practice, it is impossible to achieve an error free sample even using unbiased sampling methods. However, we can minimize the error by employing appropriate sampling methods. The various sampling methods can be classified into two categories. These are random sampling methods and non-random sampling methods. Let us discuss them in detail.

1.Random sampling(Probability sampling)

2.Non- Random sampling(Non_Probability sampling)

1.Random Sampling Methods:

The random sampling method is also often called probability sampling. In random sampling all units or items in the population have a chance of being chosen in the sample. In other words a random sample is a sample in which each element of the population has a known and non-zero chance of being selected. Random sampling always produces the smallest possible sampling error. In the real sense, the size of the sampling error in a random sample is affected only by a random chance. Because a random sample contains the least amount of sampling error, we may say that it is an unbiased sample. Remember that we are not saying that a random sample contains no error, but rather the minimum possible amount of error. The major advantage of random sampling is that it is possible to quantify the magnitude of the likely error in the inference made and this will help in building confidence in drawing inferences. The following are the important methods of random sampling:

I)Simple Random Sampling(unrestricted)

II)Restricted random sampling

I. Simple Random Sampling:

The most commonly used random sampling method is simple random sampling method. A simple random sample is one in which each item in the total population has an equal chance of being included in the sample. In addition, the selection of one item for inclusion in the sample should in no way influence the selection of another item. Simple random sampling should be used with a homogeneous population, that is, a population consisting of items that possess the same attributes that the researcher is interested in. The characteristics of homogeneity may include such as age, sex, income, social/religious/political affiliation, geographical region etc. The best way to choose a simple random sample is to use random number table. A random sampling method should meet the following criteria.

- a) Every member of the population must have an equal chance of inclusion in the sample.
- b) The selection of one member is not affected by the selection of previous members.

i) The lottery method:- This is the simplest and most familiar procedure of random sampling if a sample of 10 students is to be drawn out of a list of 50 students in a section, take 50 equal size chips or slips of paper; number them from 1 to 50 each bearing only one number. Roll each slip, put the rolled slips in a global container and thoroughly shuffle or mix them take 10 chips from the container one after another. Each time before drawing a chip, mix the chips in the container thoroughly; the units bearing the numbers of chips drawn constitute the random sample. In the above sampling procedure, there are two alternatives. After a number is selected by draw it may be replaced and consequently it has a chance of being selected again such a method is known as sampling with

replacement. This is usually referred to as unrestricted random sampling. Alternatively, the selected number is set aside, and so in the subsequent draws it does not get a chance of being selected again. This type of sampling is known as sampling without replacement. This is a form of restricted sampling. Sampling with replacement, guarantees each element an equal and independent chance of being selected in each draw. However, an element previously drawn and replaced in the vessel has a chance of being drawn again. But the woman procedure is not to count it again as an item of the sample for, it is absurd to ask a respondent to fill in a questionnaire twice. Lottery method is useful for drawing a small sample from a small population. But it would be time consuming and tedious if the population is very large.

ii) The use of table of random numbers:- This is a less cumbersome, but equally valid procedure of sample selection tables of random numbers have been developed by Kendall and Smith (1939). Fisher and Yates (1963) and Tippet (1927). One of them is usually found in a standard book on statistics or methodology of research. To select a random sample out of a given frame, one should simply start to read numbers from a table of random numbers at any randomly selected point and pick out numbers within the range of the frame. This procedure is illustrated below: Let us suppose that random sample of 50 is to be selected from a college population of 500 commerce students. We can use any table of random numbers.

iii) Use of Computer:- If the population is very large and if computer facilities are available, a computer may be used for drawing a random sample. The computer can be programmed to print out a series of random numbers as the researcher desires.

II.Restricted random sampling

i) Stratified Random Sampling

ii) Cluster Sampling

iii) Multistage Sampling

vi) Systematic Sampling

v) Random Route Sampling

i) Stratified Random Sampling:

The stratified sampling method is used when the population is heterogeneous rather than homogeneous. A heterogeneous population is composed of unlike elements such as male/female, rural/urban, literate/illiterate, high income/low income groups, etc. In such cases, use of simple random sampling may not always provide a representative sample of the population. In stratified sampling, we divide the population into relatively homogenous groups called strata. Then we select a sample using simple random sampling from each stratum. There are two approaches to decide the sample size from each stratum, namely, proportional stratified sample and disproportional stratified sample. With either approach, the stratified sampling guarantees that every unit in the population has a chance of being selected. We will now discuss these two approaches of selecting samples.

Advantages

a) Since the sample are drawn from each of the stratum of the population, stratified sampling is more representative and thus more accurately reflects characteristics of the population from which they are chosen.

b) It is more precise and to a great extent avoids bias.

c) Since sample size can be less in this method, it saves a lot of time, money and other resources for data collection.

Limitations

a) Stratified sampling requires a detailed knowledge of the distribution of attributes or characteristics of interest in the population to determine the homogeneous groups that lie within it. If we cannot accurately identify the homogeneous groups, it is better to use simple random sample since improper stratification can lead to serious errors.

b) Preparing a stratified list is a difficult task as the lists may not be readily available.

ii) Cluster Sampling:

In cluster sampling we divide the population into groups having heterogeneous characteristics called clusters and then select a sample of clusters using simple random sampling. We assume that each of the clusters is representative of the population as a whole. This sampling is widely used for geographical studies of many issues. For example if we are interested in finding the consumers' (residing in Delhi) attitudes towards a new product of a company, the whole city of Delhi can be divided into 20 blocks. We assume that each of these blocks will represent the attitudes of consumers of Delhi as a whole, we might use cluster sampling treating each block as a cluster. We will then select a sample of 2 or 3 clusters and obtain the information from consumers covering all of them. The principles that are basic to the cluster sampling are as follows:

- i) The differences or variability within a cluster should be as large as possible. As far as possible the variability within each cluster should be the same as that of the population.
- ii) The variability between clusters should be as small as possible. Once the clusters are selected, all the units in the selected clusters are covered for obtaining data.

Advantages

- a) The cluster sampling provides significant gains in data collection costs, since traveling costs are smaller.
- b) Since the researcher need not cover all the clusters and only a sample of clusters are covered, it becomes a more practical method which facilitates fieldwork.

Limitations

- a) The cluster sampling method is less precise than sampling of units from the whole population since the latter is expected to provide a better cross-section of the population than the former, due to the usual tendency of units in a cluster to be homogeneous.
- b) The sampling efficiency of cluster sampling is likely to decrease with the decrease in cluster size or increase in number of clusters. The above advantages or limitations of cluster sampling suggest that, in practical situations where sampling efficiency is less important but the cost is of greater significance, the cluster sampling method is extensively used. If the division of clusters is based on the geographic sub-divisions, it is known as area sampling. In cluster sampling instead of covering all the units in each cluster we can resort to sub-sampling as two-stage sampling. Here, the clusters are termed as primary units and the units within the selected clusters are taken as secondary units.

iii) Multistage Sampling:

We have already covered two stage sampling. Multi stage sampling is a generalisation of two stage sampling. As the name suggests, multi stage sampling is carried out in different stages. In each stage progressively smaller (population) geographic areas will be randomly selected. A political pollster interested in assembly elections in Uttar Pradesh may first divide the state into different assembly units and a

sample of assembly constituencies may be selected in the first stage. In the second stage, each of the sampled assembly constituents are divided into a number of segments and a second stage sampled assembly segments may be selected. In the third stage within each sampled assembly segment either all the house-holds or a sample random of households would be interviewed. In this sampling method, it is possible to take as many stages as are necessary to achieve a representative sample. Each stage results in a reduction of sample size. In a multi stage sampling at each stage of sampling a suitable method of sampling is used. More number of stages are used to arrive at a sample of desired sampling units.

Advantages

- a) Multistage sampling provides cost gains by reducing the data collection on costs.
- b) Multistage sampling is more flexible and allows us to use different sampling procedures in different stages of sampling.
- c) If the population is spread over a very wide geographical area, multistage sampling is the only sampling method available in a number of practical situations.

Limitations

- a) If the sampling units selected at different stages

iv) Systematic Sampling:

In systematic sampling the sample units are selected from the population at equal intervals in terms of time, space or order. The selection of a sample using systematic sampling method is very simple. From a population of 'N' units, a sample of 'n' units may be selected by following the steps given below:

- i) Arrange all the units in the population in an order by giving serial numbers from 1 to N.

ii) Determine the sampling interval by dividing the population by the sample size. That is, $K=N/n$.

iii) Select the first sample unit at random from the first sampling interval (1 to K).

iv) Select the subsequent sample units at equal regular intervals.

For example, we want to have a sample of 100 units from a population of 1000 units. First arrange the population units in some serial order by giving numbers from 1 to 1000. The sample interval size is $K=1000/100=10$. Select the first sample unit at random from the first 10 units (i.e. from 1 to 10). Suppose the first sample unit selected is 5, then the subsequent sample units are 15, 25, 35,.....995. Thus, in the systematic sampling the first sample unit is selected at random and this sample unit in turn determines the subsequent sample units that are to be selected.

Advantages

i)The main advantage of using systematic sample is that it is more expeditious to collect a sample systematically since the time taken and work involved is less than in simple random sampling. For example, it is frequently used in exit polls and store consumers.

ii) This method can be used even when no formal list of the population units is available. For example, suppose if we are interested in knowing the opinion of consumers on improving the services offered by a store we may simply choose not representative multistage sampling becomes less precise and efficient.

V)Random Route Sampling

The method is used in market research surveys mainly for sampling households,shops,garages and other premises in urban areas.Address is selected at random from sampling frame as a starting point.Interviewer then give instructions to identify further addresses by taking alternate left-and right – hand turns at road junctions and calling at every nth address (shop,garage etc.)

Advantages

1. May be saving in time
2. Bias may be reduced because interviewer has to call at clearly defined addresses.

Limitations

1. Characteristics of particular areas may mean that sample is not representative.
2. Open to abuse by interviewer because there is a difficulty to check that whether the instructions are fully carried out or not.

2. Non- Random sampling (Non_Probability sampling)

Non-probability sampling does not adopt the theory of probability and it does not give a representative sample of the population. The primary methods of non-probability sampling are:

- ⊗ Convenience sampling
- ⊗ Purposive (or Judgement) sampling
- ⊗ Quota sampling
- ⊗ Accidental sampling
- ⊗ Snow-ball sampling

A) Convenience or Accidental Sampling:-

This is non probability sampling. It means selecting sample units in a just hit and miss fashion e.g. interviewing people whom we happen to meet. This sampling also means selecting whatever sampling units are conveniently available e.g. a teacher may select student in his class. This method is also as accidental sampling because the respondents whom the researcher meets accidentally are included in the sample.

Usefulness:- Though convenience sampling has no status it may be used for simple purpose such as testing ideas or gaining ideas or rough impression about a subject of interest. It lays a groundwork for a subsequent probability sampling sometimes it may have to be necessarily used. For example, when a population cannot be defined or a list of population is not available there is not other alternative than to use convenient sampling.

Advantages:-

1. Convenience sampling is the cheapest and simplest
2. It does not require a list of population
3. It does not require any statistical expertise.

Disadvantages:-

1. Convenience sampling is highly biased, because of the researcher's subjectivity, and so it does not yield a representative sample.
2. It is the least reliable sampling method. There is no way of estimating the representatives of the sample.
3. The findings cannot be generalized.

B) Purposive or Judgement Sampling

This method means deliberate selection of sample units that confirm to some pre-determined criteria. This is also known as Judgement Sampling. This involves selection of cases which we judge as the most appropriate ones for the given study. It is based on the judgement of the researcher or some expert. It does not aim at securing a cross section of population. The chance that a particular case be selected for the sample depends on the subjective judgement of the researcher for example a researcher may deliberately choose industrial undertakings in which quality circles are believed to be functioning successfully and undertakings in which quality circles are believed to be total failure.

Application:- The method is appropriate when it is important that the typicality and specific relevance of the sampling units to the study and not their overall representativeness to the population.

Advantages:- The advantages of purposive or judgement sampling etc.

1. It is less costly and more convenient.
2. It guarantees inclusion of relevant elements in the sample, probability sampling plans cannot give such guarantee.

Disadvantages:- The demerits of judgement sampling are:

- 1 This does not ensure the representativeness of the sample
- 2 This is less efficient for generalizing when compared with random sampling
- 3 This method requires more prior extensive information about the population one studies without such information, it is not possible to adjudge the suitability of the sample items to be selected.
- 4 This method does not lend itself for using inferential statistics, because, this sampling does not satisfy the underlying assumption of randomness.

C Quota Sampling:-

This is a form of convenient sampling involving selection of quota groups of accessible sampling units by traits such as sex, age social class etc. when the population is known to consist of various categories by sex, age, religion, social classes, etc. in specific proportions, each investigator may be given an assignment of quota groups specified by the pre-determined traits in specific proportions. He can then select accessible persons belonging to those quota groups in the area assigned to him. Quota sampling is therefore a method of stratified sampling in which selection within strata is non-random. It is this non-random element that constitutes its greatest weakness.

Quotas are stratified by such variables as sex, age, social class and religion. It is easy to classify the accessible respondents under sex, age and religion, but it is very difficult to classify them into social categories. Since social class usually involves a combination of factors such as occupation income and caste and the interviewer's subjective judgement and bias play some role in the social class classification of respondents.

Application:- Quota sampling is used in studies like marketing surveys, opinion polls and leadership surveys which do not aim at precision, but to get quickly some crude results.

Advantages:- The major advantages of quota sampling are:

- 1 It is considerably less costly than probability sampling.
- 2 It takes less time.
- 3 There is no need for a list of population. Thus quota sampling is a suitable method of sampling a population for which no suitable frame is available.
- 4 Field work can easily be organized, strict supervision need not be required.

Disadvantages:- The method of quota sampling suffers from certain major shortcomings.

- 1 It may not yield a precise representative sample and it is impossible to estimate sampling error. The findings, therefore, are not generalizable to any significant extent.
- 2 interviewers may tend to choose the most accessible persons; they may ignore slums or areas difficult to reach. Thus they may fail to secure a representative sample within their quota groups.
- 3 Strict control of field work is difficult
- 4 It is difficult for sampling on more than three variables dimensions. This is because the number of categories to be selected is a multiplication of the number of values in each variable for instances if we want to sample proportionate number of persons by sex,

social status and age and these variables consist of two, three and three categories respectively, we have to and three categories respectively, we have to select $2 \times 3 \times 3 = 18$ categories of respondents.

5 The quota of sampling is subject to a higher degree of classification error, because the investigators are likely to base their classification or respondent's social status and economic status mostly on their impressions about them.

D) Snow-ball Sampling:-

This is the colourful name for a technique of building up a list or a sample of a special population by using an initial set of its members as informants. For example, if a researcher wants to study the problem faced by Indians through some source like Indian Embassy. Then he can ask each one of them to supply names of other Indians known to them and continue this procedure until he gets an exhaustive list from which he can draw a sample or make a census survey. This sampling technique may also be used in socio-metric studies. For example, the members of a social group may be asked to name the persons with whom they have social contracts, each one of the persons so named may also be asked to do so and so on. The researcher may thus get a constellation of associates and analyse it. Advantages:-

Advantages :-

1. It is very useful in studying social groups, informal group in a formal organization, and diffusion of information among professionals of various kinds.
2. It is useful for smaller populations for which no frames are readily available.

Disadvantages:-

1. The major disadvantages of snow-ball sampling is that it does not allow the use of probability statistical methods. Elements included are dependent on the subjective choice of the original selected respondents.

2. It is difficult to apply this method when the population is large.

3. It does not ensure the inclusion of all elements in the list.