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OVERVIEW OF SAMPLE AND SAMPLING METHODS

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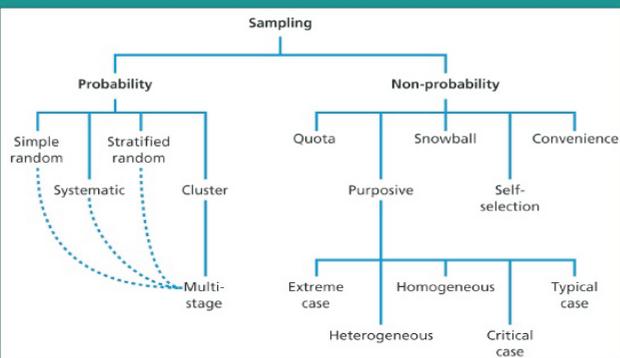
ABSTRACT

In any research conducted, people, places, and things are studied. The opportunity to study the entire population of those people, places, and things is an endeavor that most researchers do not have the time and/or money to undertake. The idea of gathering data from a population is one that has been used successfully over the years and is called a census. This method is mentioned several times in the bible (Wikipedia). It was also used by the Ancient Egyptians "to obtain empirical data describing their subjects" (Babbie 37). In past years, the idea of collecting data from the entire population was used by political entities to collect opinions about potential political candidates. Census data collection is still very popular for collecting public opinion for political endeavors. For most researchers, however, collecting data from an entire population is almost impossible because of the amount of people, places, or things within the population. Taking a census involves much time and money; something to which most researchers are not accustomed. To collect data on a smaller scale, researchers gather data from a portion or sample of the population.

KEYWORDS :Sample & Sampling, Sample , Sampling methods.

Sample –

A sample is the small collection of the population selected with the objective to show or tell properties of the concerned populations.

The word population or universe as used in statistic denotes the aggregate from which the sample is to be taken.

Sampling –

The methodology of sample is known as sampling. In sampling technique instead of every unit of the population or universe, only a part of all universe is studied and the conclusion are drawn on that basis for the entire universe. In fact a sample is a sub-set of population unit.

TYPES OF SAMPLING METHODS -
There are two types of sampling techniques:
I. Random or probability sampling,
II. Non random or nonprobability sampling.

Sampling methods

Random Sampling	Non random sampling
Includes:	Includes:
Simple random	Convenience sampling
Stratified random	Purposive sampling
Systematic sampling	Quota sampling
Cluster sampling	
Multistage sampling	
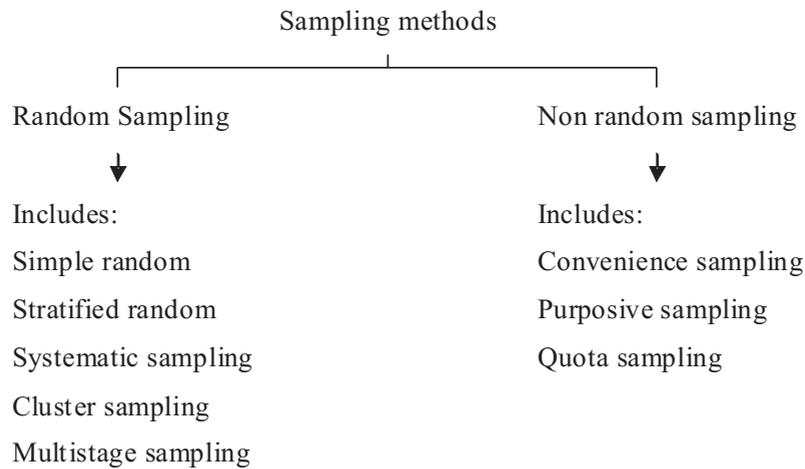
Fug, 3.1 Types of sampling methods.

I) RANDOM OR PROBABILITY SAMPLING -

In random sampling a sample is selected in such a way that each and every element in the population has an equal chance of being included in the sample. It means random sampling is made without deliberate discrimination or purpose. Therefore, it is also called unbiased or n on preferential sampling. Random sample should be large, because larger the sample, lesser will be the variation of characteristics from one random sample to another. A random sample must be selected in such a way that every clement in the population has an equal opportune hang included in the sample.

Example 1 Suppose there is a deck of 52 card thoroughly shuffled. You are asked to draw 5 cards. The hand thus picked up is a random sample of population of 52 cards, because every card in the deck had an equal opportunity of Inclusion In the hand and every set of 5 cards had an equal opportunity of selection.

SELECTION OF RANDOM SAMPLES -
Selection of a random sample can be carried out in two ways:
1. Sampling without Replacement: In this type of sampling an observation is included in the sample only once and is selected randomly without any preference or conscious effort.
Examples:
1. One wants to study the colour of 500 cows. He can randomly select 10 cows as a sample without making any discrimination.
2. Say out of a deck of 52 cards If you pick up any 20 cards without looking at them, the sample of 20 cards In the hand Is a sample without replacement.
For second sample, he selects another 10 cows. Here first 10 cows do not gel chance to be selected in the second sample because they writ- not replaced in the population of 500 cows from which second sample was to be drawn.
2. Sampling with Replacement: In this type of sampling an observation has a chance to be selected at each draw.

Examples :

1) In an experiment the researcher selects on« cow, notes its colour and mixes it back into the herd. As a result, this cow has a chance to be picked up at each selection. This is also termed as unbiased sampling in which selection Is made without deliberate discrimination.

2) Say out of a deck of 52 cards, you pick up any four cards in one sample. These are placed back In the deck. These four cards are again available for second sample. This is sampling with replacement.

Random sampling is also referred to as probability sampling, since if sampling process is random, the laws of probability can be applied. In cont of random sampling, random is not used in the sense of haphazard. Random sampling suggests that selection should be made without deliberate discrimination.

A non-random sample is selected on a basis other than probability considerations such as expert judgement, convenience or some other criteria.

For scientific research purposes, Random sampling is only applied. Random sampling is of following two types :

(1)   Simple random sampling,

(2)   Restricted random sampling,

[I] Simple random sampling (SRS) -

Simple random sampling refers to the sampling technique in which each and every item of the population is given an equal chance of being included in the sample. The selection is thus free from personal bias because the investigator does not exercise his discretion or preference in the choice of items. Since selection of items in the sample depends entirely on chance. This method is also known as the method of chance selection.

In this method samples are chosen at random and each member or sample unit of the population has an equal chance of being selected in the sample. The selection is made without deliberate discrimination. This method is well applicable when the population is small, homogeneous and readily available, e.g., fishes present in the aquarium. In this sampling method every unit of the population has an equal chance of being selected. Hence, this method is, sometimes, also called unrestricted random sampling. SRS eliminates the possibility of any bias selection.

stratified random sampling — Samples chosen at random on line.

strata — Samples chosen at random with strata on usually different in size and based on a prior information about variation and the site.

second stage unit / primary (first stage) unit — Primary units chosen at random. Samples chosen at random within selected primary units.

clusture sampling / two clustures — All possible samples taken within randomly selected clusters.

systemic sampling — Sample evenly spaced after a random start position A.

random sampling within segments — Segments may be of different size, not based on a prior information about the size or variation
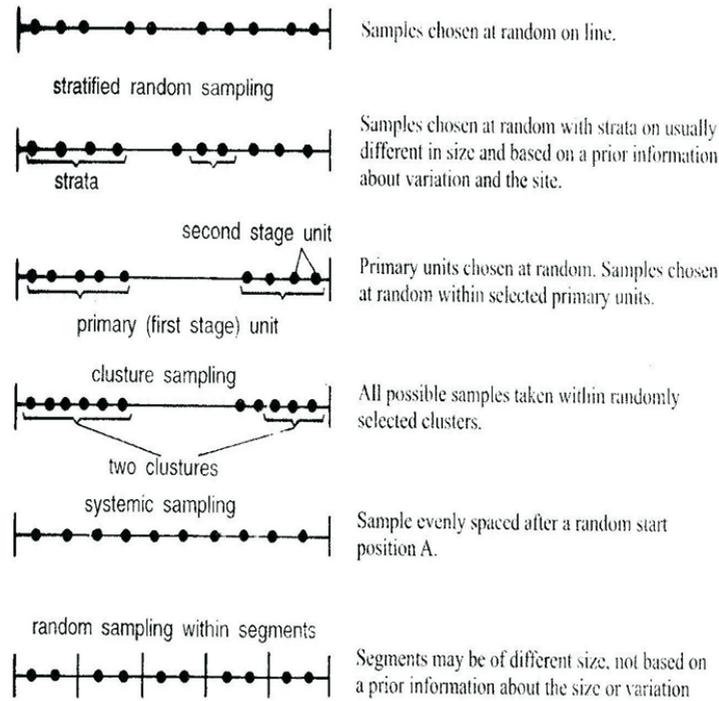
Fig- Some random sampling plans for sampling over time or along a transect to estimate a mean of total.

regular distribution   random distribution   contagious distribution
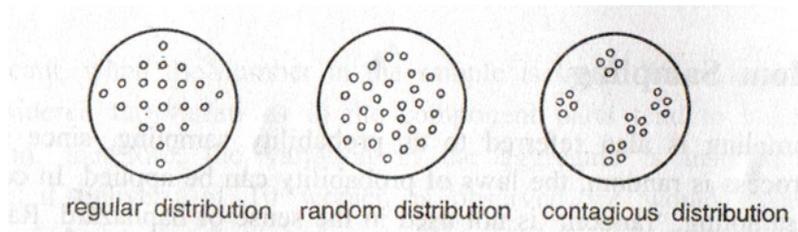
Fig- Examples of Regular Random and Contagious distributions of individuals in an area

simple random sampling   stratified random sampling   systemic grid sampling

two stage sampling   cluster sampling   random sampling within block
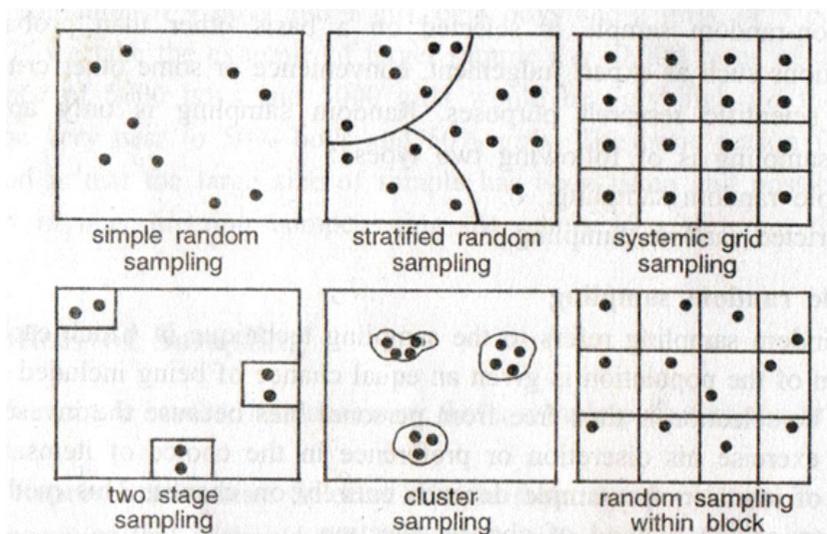
Fig- Some two dimensional probability sampling designs for sampling over space.

Methods of obtaining a simple random sample –

To ensure randomness of selection one may adopt any of the following methods.

1) Lottery method - This is the simplest and most popular method of taking a random sample. Under this method all items of the universe/ population are numbered or named on separate slips of paper of identical shape, size, and colour. These slips are thru folded and mixed up in a container or drum. A blindfold selection is thru made of the number of slips required to constitute the desired size of the sample. The selection of items thus depends entirely on chance. The method would be quite clear with the help of an example. If we want to take a sample of 100 patients out of a population of 1000, the procedure is to write the names of all the 1000 patients on separate slips of paper, fold these slips, mix them thoroughly and then make a blindfold selection of 100 slips.

While adopting lottery method it is absolutely essential to see that the slips are of identical size, shape, colour, etc., otherwise there is a lot of possibility of personal prejudice and bias affecting the results.

**2) Table of random numbers -** The lottery method discussed above becomes difficult if the population size is very large. An alternative method of random selection is that of using the table of random numbers. Three such tables are available, namely, (i) Tippett's table of random numbers, (ii) Fisher and Yale's numbers and (iii) Kendall and Babington Smith numbers. Tippett's numbers are most popular. They consist of 41,600 digits taken from census reports and combined by fours to give 10,400 four—figure numbers. We give here the first forty sets as an illustration of the general appearance of random numbers :

2952	6641	3992	9792	7679	5911	3170	5624
4167	9524	1542	1396	7203	5356	1300	2693
2370	7483	3408	2762	3563	1089	6913	7691
0560	5246	1112	6107	6008	8126	4233	8776
2754	9143	1405	9025	7002	6111	8816	6446

It is important that the starting point in the table of random numbers be selected in some random fashion so that every unit has an equal chance of being selected.

An example to illustrate how Tippett's table of random numbers may be used is given below. Suppose we have to select 20 rats out of 6,000 kept in a big case. The procedure is to number all the 6,000 items from 1 to 6,000. A page from Tippett's table may then be consulted and the first twenty numbers up to 6,000 noted down. Rats bearing those numbers will be included in the sample. Making use of the portion of the table, given below, the required numbers are :

2952	3992	5911	3170	5624	4167
1545	1396	5356	1300	2693	2370
3408	2762	3563	1089	0560	5246
1112	4233				

Rats bearing above number constitute the sample.

Universe size less than 1,000. If the size of universe is less than 1,000 the procedure will be different, as Tipptett's numbers are available only ii four figures. Thus, for example, if it is desired to take a sample of 10 Item; out of 400 all items from 1 to 400 should be numbered as 0001 to 0400. W< may

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now select 10 numbers from the table which are up to 0400.

Universe size less than 100. If the size of universe is less than 100, the table is used as follows : suppose ten numbers from out of 0 to 80 are required. We start anywhere in the table and write down the numbers in pairs. The table can be read horizontally, vertically, diagonally, or in any other methodical way. Starting with the first and reading horizontally. we obtain 29, 52, 66, 41, 39, 92, 97, 92, 79 69, 59, II, 31. 70. 56, 24. 41. 67 and so on. Ignoring the numbers greater than 80 we obtain for our purpose ten random numbers, namely, 29, 52, 66, 41, 39, 79, 69, 59, 11 and 31.

Fisher and Yate's tables consist of 15,000 numbers. These have been arranged in two digits in 300 blocks, each block consisting of 5 rows and 5 columns. However, this method cannot be followed in case of qualitative data.

Merits of random sampling -
(a) Less time. Sampling saves time because experiment is performed with only a part of the population. Time is saved not only in collecting data but also in processing it.

(b) Less cost. Sampling method reduces the cost of experiment because only a few selected items are studied in sampling.

(c) Best for infinite population. In case of infinite population, sampling is the only method which can be used.

(d) More reliable results. The result obtained from sample is more reliable than that obtained from a complete count. There are several reasons for it. First, it is always possible to determine the extent of sampling errors. Secondly, other types of errors to which a survey is subject are likely to be more serious in a complete census than in a sample survey.

(e) The destructive nature of certain tests. My tests axe of destructive nature. Toxicity tests on organisms can be done only on a part of population, We cannot apply toxins to entire population.

Limitations of random sampling. Despite the various advantage sampling, it is not altogether free from limitations. Some of the limit involved in sampling are stated below :

1)Sometimes the population may be so small that it may be impossible draw a representative sample from it.

2)The result computed from sample may be false, inaccurate misleading if the sample has not been drawn properly.

3)There may be personal bias with regard to the choice of technique drawing of sampling units.

4)At times the sampling plan may be so complicated that it requires r time, labour and money than a complete count.

5)If the information is required for each and every unit in the domain study, a complete enumeration survey is necessary.

Although there may be some shortcoming in sampling techniques, yet, it is a very useful method for bio statistical investigation According to F.F. Stephen "Samples are like medicines I hey can harm only when they are taken carelessly." Every good Sample should have a proper label with instructions about its use. Professor Chou States, "Sampling is a simple process of learning about the population on the basis of a sample drawn from it."

Properties of Random Samples -
The properties of random samples are:
The several samples drawn from the same population will differ, i.e., their statistical

characteristics will change from sample to sample.

Random sample should be large, because- larger the sample, lesser will be the variation of characteristics of the sample from one random sample to another.

A random sample must be selected in such a way that every element in the population had an equal opportunity of being included in the sample.

OBJECTIVES OF RANDOM SAMPLING -
The random sampling is carried out with following objectives:

To obtain the maximum information about the characteristics of the population with the available resources at our disposal in terms of time, money and manpower by studying the sample values only.

To obtain best possible estimates of the population parameters.

Advantages of Random Sampling -
The main advantages of using random sampling are:

The random sampling enables the researcher to draw inferences about the whole population.

It eliminates personal bias. The researcher cannot reject those observations which do not support his theory. Similarly, researcher cannot select only those observations which may support his theory.

In this method samples are chosen at random and each member or sample unit of the population has an equal chance of being selected in the sample. The selection is made without deliberate discrimination. This method is well applicable when the population is small, homogeneous and readily available, e.g., fishes present in the aquarium. In this sampling method every unit of the population has an equal chance of being selected. Hence, this method is, sometimes, also called unrestricted random sampling. SRS eliminates the possibility of any bias selection.

II) Restricted random sampling –
Restricted random sampling are of following types :
1. Systematic sampling. This method is used in those cases where are complete list of the population from which sampling is to be drawn available. This method is to select every Kth   item from the list where refers to the sampling interval. The starting point between the first and Kth item is selected at random. K is calculated by the formula :

$$K = \frac{\text{Size of the universe}}{\text{sample size}} = \frac{N}{n}$$

For example, if a pond consists of 1,000 fishes of a species and if we want to draw a sample of 200 fishes this means we must take every fifth item (/. e., k = 5).

$$K = \frac{1000}{200} = 5$$

The first item between one and five shall be selected at random. Suppose it comes out to be

three. Now we shall go on adding five and obtain numbers of the desired sample. Thus the second items would be

This is a simple procedure and utilized when a complete list of population from which a sample is to be drawn is available, it is more often applied to field studies when the population is large, scattered and heterogeneous. In this sampling method samples drawn are evenly quail alter a random start position A is chosen This is the most practical way of sampling. From a large population, samples are selected every 10th, 20th, 25th or 50th item.

Suppose, a researcher wants to take 20 cases (nun 500 Hb values. All the 500 values are arranged in some order and one observation is taken from each of the 25 observations systematically. The value among the first 25 observations is selected randomly. Suppose this random start point (A) u 10 The value of 10th observation in first sample is the start point. After every 25th observation, At sample will consist of the values of 10th, 35th, 60th, 85th, ... In such a sample all sections of population are adequately represented.

MERITS OF SYSTEMATIC SAMPLING:

• It is simple method because sample is determined easily.

• Result calculated are satisfactory.

• It saves time and money.

Limitations of systematic sampling. (1) Systematic sampling becomes a representative design than simple random sampling if we are link with populations having hidden periodicities.

2) Stratified Random sampling. This method is followed when the population is not homogeneous. The population under study is first divided into icons groups or classes called stratas. Then the sample is drawn cli stratum by simple random method in proportion to its size. The resulting sample is called a stratified sample.

This method of sampling is for giving representation to all strata of on such as selecting sample from defined areas, classes, ages, sexes is technique gives more representative sample than simple random g in a given large population. For example, if population is divided into four states, their respective sizes being 15, 10, 20, 55% of the ion and a sample of 1,000 is to be drawn, the desired proportional may be obtained in the following manner :

From stratum one   1,000 (0.l5)= 150 items
From stratum two   1,000(0.10)= 106 items
From stratum three 1,000(0.20)= 200 items
From stratum four   1,000 (0.55)= 550 items
Sample size = 1,000

Proportional stratification yields a sample that represents the universe --pect to the proportion in each stratum in the population. This is satisfactory if there is no great difference in variation from stratum. But it is not efficient procedure, especially when there is table variation in different stratas.

Stratified random sampling is done in heterogeneous populations having different groups with different characteristics. Stratification is used in complex sample designs. The population for sampling is first divided into homogeneous groups or classes, called strata. A separate simple random sample is drawn from each strata. The total SRS together form a complete sample. The samples collected from different strata need not be of the same size and are often based on some priority information about the variation in a population, so that the variability in each stratum is adequately represented in the sample.

Example: To estimate average weight of persons from a heterogeneous population of three females and three males stratified random sampling is used. Here males form one stratum and female form another stratum In the population and sample in drawn from each stratum so that, the variability in each stratum Is adequately represented in the sample.

Merits of stratified sampling:
• Sample selected by this method is true representative of the population.
• Sample has maximum accuracy.
• This method offers reliable and meaningful results.
• Proportionate representative sample from each group is secured and it gives greater accuracy. Stratified samples can be more concentrated geographically.

Limitations. Utmost care must be exercised in dividing the population various stratas. Failing the point the results may not be reliable.

3. Cluster sampling. A cluster is randomly selected group. This method is used when units of population are natural as groups such as schools of fishes, hospital ward, slums of u town etc. The techniques of cluster sampling allows small number of the target population to be sampled while the data provided statistically valid at 95% confidence limits.

As per module approved by W.H.O. it is most often used to evaluate vaccination.
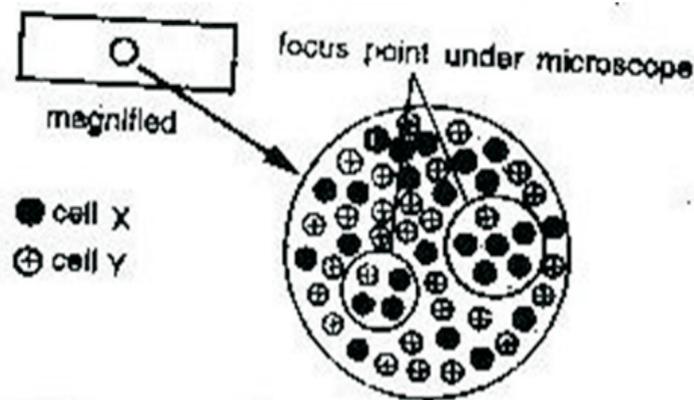

Fig- Showing biased sampling for determining the mean number of cell X in a particular tissue structure. Focusing microscope field to the aggregated area of cell X, as a biased result of no of cell X is found in greatest number.

In this method the units of population are natural groups of elements These groups are called dusters. Each cluster includes only one type of elements. A simple random simple is taken from each cluster.

Cluster sampling provides best results only when the elements within the cluster are heterogeneous \ cluster can be regarded as a small scale version of the entire population. In case each cluster is urn- representative of the population, sampling of a small number of clusters will provide good estimates of population parameters. A cluster may consist of units such as villages, wards, blocks, factories, slums of a town, children of a school, hospital wards etc.

4. Multistage Sampling: In multistage sampling, the clusters or segments are selected in the primary cluster sample and these secondary clusters are again sampled instead of being fully injected. This is also described as random sampling within segments. This method is curried He in several stages using random sampling techniques. This procedure is employed in large scale survey carried out country wise or region wise.

II. NONRANDOM OR NONPROBABILITY OR DELIBERATE SAMPLING

In nonrandom sampling, the samples are drawn without following any specific procedure or any yardstick. The sample collected does not show any specific approach nor the samples can be used to assess properly the accuracy of the estimator. In this sampling procedure many investigator biases are likely to occur. The nonrandom sampling can be of following three types:

1. Convenience Sampling: This is known as accidental accessibility or haphazard sampling, The major reason is administrative convenience. The sample is chosen with ease of access being the sole concern.

2. Purposive or Biased Sampling: This is also known as judgmental sampling. The experimenter exercises deliberate subjective choice in drawing the representative sample. The judgmental sampling aims at elimination of anticipated sources of distortion, but there will always remain the risk of distortion due to personal prejudices or lack of knowledge of certain crucial features in structure of the population.

In biased or purposive selection, all units ul tin- defined population are not represented in the hiased sample or we can say that the biased sample is not the true representative of the population.

Example A fish breeder wants to show that the fishes growing In all the ponds In a village are all disease-free and healthy, he will collect samples from ponds In which fishes are healthy. This shows biased sampling.

Quota Sampling: This combines convenience and judgement and is more structured than fiiher of the two. Quota sampling needs a proper statistical design to determine what numbers are needed in each of the quotas.

Quota sampling is utilised in USA. In this method, the investigator is given instructions about i main characteristics (such as age, sex and socioeconomic status of the subjects to be selected). I lie proportions in various groups being chosen should agree with the corresponding proportions in ill.-population. It is possible with this method to h.ive serious discrepancies between the sample and population.

It is a type of judgment sampling in this method quotas are set up for each specified characteristics, such as age, religion, rural or urban salary groups etc. Each interview is asked to collect information accordingly, But the choice of (selection of) the respondents is left to the judgment of the investigators. The reliability of this method mainly depends upon the efficiency, integrity and skill of the investigator. For example, if we want to know the public opinion about the central government budget for 2000-2001 each investigator may be asked to collect information from 500 people of these at least 20 percent persons should be housewives. 10 percent fixed salaried people, 20 percent producers, 20 percents agriculturists, 10 percent self employed, 10 percent businessmen and rest 10 percent intellectuals. Within this quota the interviewer is free to select the people to be interviewed.

In this case field workers / market representatives are assigned definite quotas for business / sales according to a given criteria. It is cheap and easy type of sampling but in susceptible to several errors and bias. This is a very popular method used on marketing research.

CONCLUSION

Researchers may choose from a variety of sampling methods. The researcher goals inform which sampling method is best for the research to be conducted. The main choice in regards to sample method choice is whether or not the researcher wants to generalize the findings from the sample to the whole of the population being studied. Being aware of possible errors due to the sample method chosen is also very important because giving possible errors within the results section allows the study to be regarded as valid. Many sample method choices are available; the researcher must choose the method that is right for the study.

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