Stratified Sampling

There are two basic forms of probability sampling:

- Simple Random Sampling
- Stratified Random Sampling

A "stratum" refers to groups or categories. Here, the entire population is divided or sub-divided into groups on the basis of homogeny. This technique enhances the efficiency of the sampling by dividing the whole universe into homogenous groups or strata on the basis of certain common characteristics.

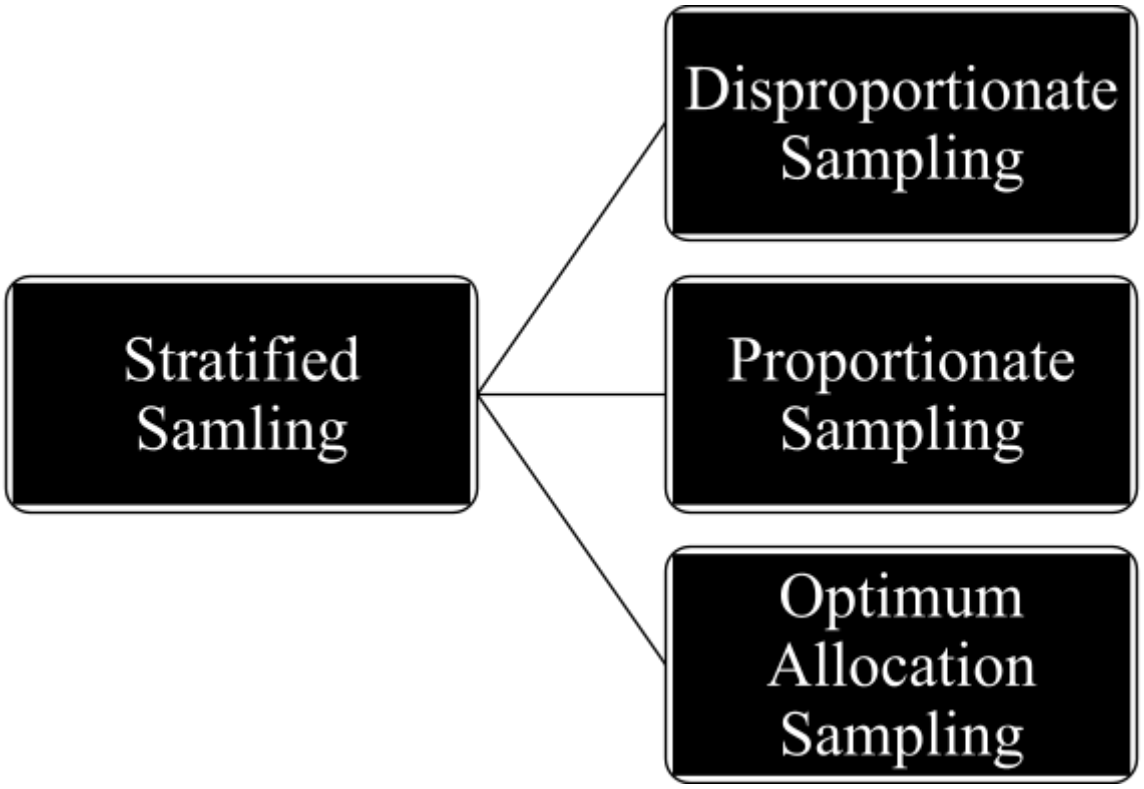
In Stratified Sampling, the researcher divides his population in strata on the basis of some characteristics and from each of these smaller homogenous groups (strata), the researcher draws a random predetermined number of units. He should choose that characteristic or criterion which seems to be more relevant in his research work. The usual stratification factors are sex, age, socio-economic status, educational background, residence (rural or urban), occupation, political-party affiliation, religion and race.

Figure 1

Demonstrating Stratified Sampling



Types of Stratified Sampling



The following three questions are highly relevant in the context of stratified sampling:

1. How to form strata?

- On the basis of common characteristics of the items to be put in each stratum.
- On the basis of past experience and personal judgement of the researcher.

2. How should items be selected from each stratum?

- Through random sampling or systematic sampling.

3. How many items be selected from each stratum or how to allocate the sample size of each stratum?

- Follow the method of proportional allocation under which the sizes of the samples from the different strata are kept proportional to the sizes of the strata.

    That is, if P_I represents the proportion of population included in stratum *i,* and *n* represents the total sample size, the number of elements selected from stratum *i* is $n*P_{I.}$

To illustrate it, let us suppose that we want a sample of size $n = 30$ to be drawn from a population of size $N = 8000$ which is divided into three strata of size $N_1 = 4000$, $N_2 = 2400$

and N_3 = 1600. Adopting proportional allocation, we can get the sample sizes as under for the different strata:

For strata with N_1 = 4000, we have P_1 = 4000/8000

And hence $n_1 = n*P_1$ = 30(4000/8000) =15

Similarly, for strata with N_2 = 2400, we have

$n_2 = n*P_2$ =30(2400/8000) = 9, and

for strata with N_3 = 1600, we have,

$n_3 = n*P_3$ = 30(1600/8000) = 6

Thus, using proportional allocation, the sample sizes for different strata are 15, 9 and 6 respectively which is in proportion to the sizes of the strata viz., 4000:2400:1600.

Guidelines:

Following guidelines should be kept in mind while using stratified random sampling technique:

- Information about strata should be up-to-date, complete, accurate, applicable to population and available to the researcher.
- Criteria or basis of stratification should be related to problem under study.
- Strata should be large enough so that there is no difficulty in locating units needed for the sample.
- Intra-homogeneity and inter-homogeneity should be ensured.
- Preferably natural pre-existing strata should be used rather than arbitrary ones.

Advantages:

- It provides a more representative cross-section of the population and is frequently regarded as the most efficient system of sampling.
- It provides estimates with increased precision. Moreover, stratified sampling enables us to obtain the results of known precision for each stratum.
- As compared with simple random sample, the stratified random samples are more concentrated geographically. Accordingly, the time and money involved in collecting the data and interviewing the individuals may be considerably reduced and the supervision of the field work could be allocated with greater ease and convenience.

- It is an objective method of sampling.
- Observations can be used for inferential purpose.

Disadvantages:

- It is difficult for the researcher to decide the relevant criterion for stratification.
- Only the criterion can be used for stratification.
- It is costly and time consuming.
- Selected sample may be representative with reference to the used criterion but not for the other.
- There is a risk in generalizations.

Steps:

The procedure for selecting a stratified sample is given below:

- Identify all elements or sampling units in the sampling population.
- Decide upon the different strata (k) into which you want to stratify the population.
- Place each element into the appropriate stratum.
- Number every element in each stratum separately.
- Decide the total sample size (n).
- Decide whether you want to select proportionate or disproportionate stratified sampling and follow the following steps:

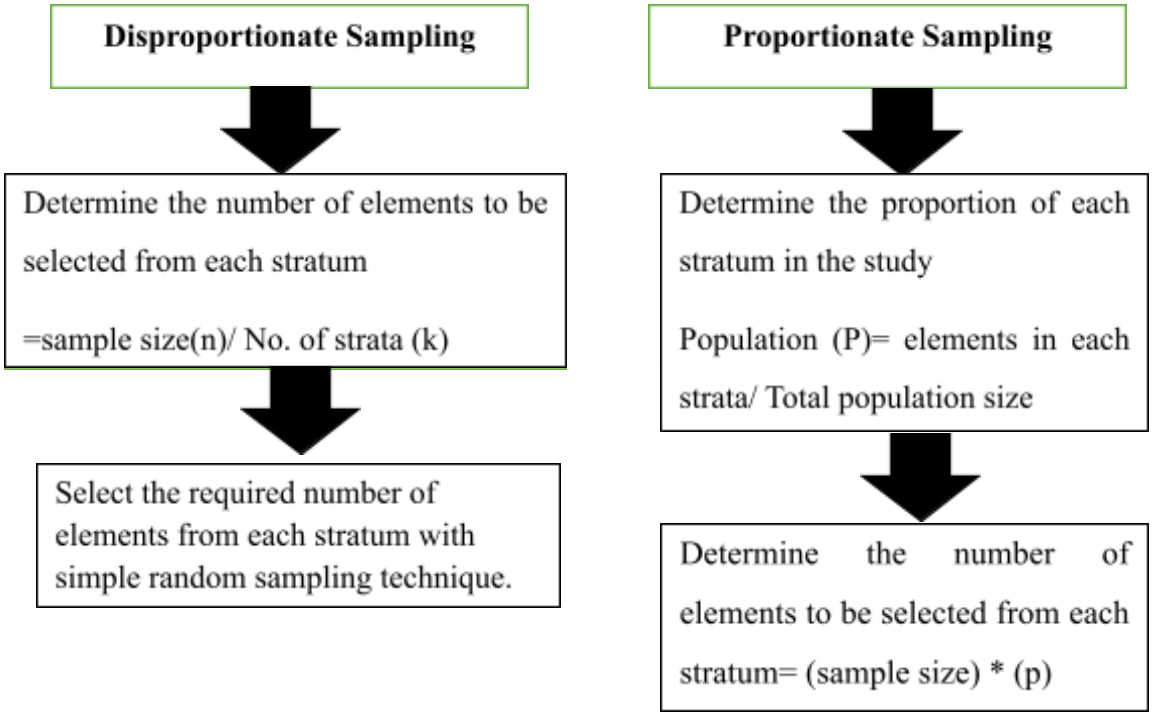


Table 1

Difference between Proportionate and Disproportionate Stratified Sampling

Aspect	**Proportionate Stratified Sampling**	**Disproportionate Stratified Sampling**
Definition	Sample size from each stratum is proportional to its size in the population.	Sample size from each stratum is not proportional to its size in the population.
Basis of Sampling	Strata sizes in the sample reflect the strata sizes in the population.	Strata sizes in the sample are chosen based on research needs or other criteria.
Purpose	Ensures representation of all strata in proportion to their population sizes.	Ensures adequate representation of smaller or specific strata that may otherwise be underrepresented.
Formula	$n_i = Ni/N*n$	Sample sizes are determined based on desired criteria, not proportion.
Advantage	Provides a representative sample for the overall population.	Allows focus on strata of particular interest, even if smaller.
Disadvantage	May not provide enough data from small strata for in-depth analysis.	Can result in a sample that does not reflect the overall population distribution.
When to use	When the goal is to reflect the population's structure accurately.	When specific strata are of higher importance or need detailed study.

Note. where, n_i represents the sample size from stratum i, N_i represents population size of stratum i, N represents total population size, n represents total sample size.

Reference:

Agarwal, L. P. (2007). *Modern Educational Research*. Dominant Publishers and Distributers.

Baker, T. L. (1994). *Doing Social Research*. McGraw-Hill International Editions.

Gupta, A. K. (2011). *Research Methodology: Methods and Techniques*. Vayu Education of India.

Kothari, C. R. (2012). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.

Mishra, B. K., Mohanty, R. K. & Saxena, N. R. (2003). *Fundamentals of Educational Research*. Surya Publications.

Pathan, R. (2013). *Research Methodology and Statistical Tools*. Centrum Press.

Sidhu, K. S. (1987). *Methodology of Research in Education*. Sterling Publishers Private Limited.

Varma, M. (2004). *An Introduction to Education and Psychological Research*. Asia Publishing House.

Venugopalan, K. (2004). *Research Methodology*. Calicut University Central Co-operative Store Ltd.