

Development of Recommendation System for Selecting a Proper Sampling Technique for Researchers in Management Based On Objectives of Research & Study Population

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Abstract — Research studies are usually carried out on sample of subjects rather than whole populations. The most challenging aspect of fieldwork is drawing a random sample from the target population to which the results of the study would be generalized. In actual practice, the task is so difficult that some sampling bias occurs in almost all studies to a lesser or greater degree. In order to assess the degree of this bias, the researcher should have some understanding of the population from which the sample was drawn. The ultimate decision on whether the results of a particular study can be generalized to a larger population depends on this understanding. The subsequent deliberations dwell on sampling strategies for different types of management research and also a brief description as well as comparison of different sampling methods based on objectives of research & study population.

Key Words — Research population, Study population, Sampling methods.

I. INTRODUCTION

Research workers in the early 19th century survey entire populations for their research. This task was tedious, and the research work suffered accordingly. Current researchers work only with a small portion of the whole population (a sample) from which they draw inferences about the population from which the sample was drawn.

This inferential leap or generalization from samples to population, a feature of inductive or empirical research, can be full of pitfalls. So, one has to critically appraise the real worth or representativeness of that particular sample. The following discussion explains how to select a proper sampling technique for researchers in management based on objectives of research & study population (Target population).

II. REVIEW OF LITERATURE

Lot of literature is available on Population and sampling techniques, so before starting the discussion about Recommendation system, let us take a review of some literatures.

2.1. Research Population.

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query. It is for the benefit of the population that researches are done. However, due to the large sizes of populations, researchers often cannot test every individual in the population because it is too expensive and time-consuming. This is the reason why

researchers rely on sampling techniques.

A research population is also known as a well-defined collection of individuals or objects known to have similar characteristics. All individuals or objects within a certain population usually have a common, binding characteristic or trait.[6]

2.1.A Two Types of Population in Research

2.1.A.i Target Population

Target population refers to the ENTIRE group of individuals or objects to which researchers are interested in generalizing the conclusions. The target population usually has varying characteristics and it is also known as the theoretical population.[6]

2.1.A.ii Study Population

The study population is the population in research to which the researchers can apply their conclusions. This population is a subset of the target population and is also known as the accessible population. It is from the study population that researchers draw their samples.[6]

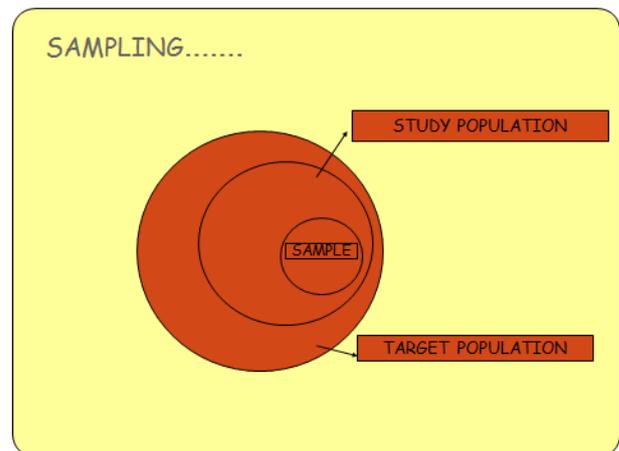


Fig. 1. Selection of sample from population.

2.2 Sample

In statistics, a sample can be defined as a subset of a population.

The population, or target population, is the total population about which information is required. Ideally, this is a population at risk. The "study population" is the population from which sample is to be drawn. Commonly, the population is found to be very large and in any research study, studying all population is

often impractical or impossible. Therefore, sample unit gives researchers a manageable and representative subset of population.[6][7]

2.2.A Sampling Frame & Sampling Unit

Before a sample is taken, members of study population need to be identified by constructing a list called a sampling frame. Each member of sampling frame is called sampling unit. For example, someone may want to know details about shopping trends of people coming to a particular grocery store on Sundays. So people coming to that grocery store on Sunday forms a sampling frame and each customer is a sampling unit.[6]

2.2.B Sampling Fraction

The sampling fraction is the ratio of sample size to study population size. For example if you choose 10 customers out of total 1000 coming to that grocery store, than the sampling fraction would be 1%. The sampling units may be individuals or they may be in groups. For example, in a particular study involving animals, one can select individual animals or groups of animals like in herds, farms, or administrative regions.[6]

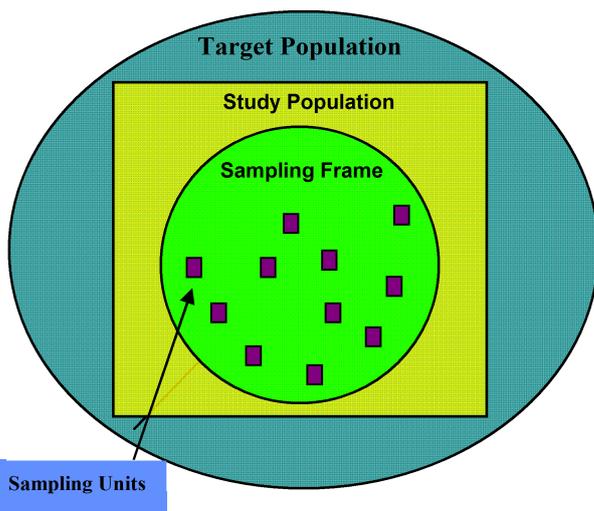


Fig. 2. Selection of sampling frame & sampling units.

III. TYPES OF SAMPLING

There are various types of sampling methods employed by researchers in Management, out of which most frequently used sampling techniques are discussed below in present study.

3.1 Probability Sampling

In probability sampling, every individual in the population have equal chance of being selected as a subject for the research.

This method guarantees that the selection process is completely randomized and without bias. The advantage of using probability sampling is the accuracy of the statistical methods after the experiment. It can also be used to estimate the population parameters since it is representative of the entire population. It is also a reliable method to eliminate sampling bias.[6]

Here we discuss some mostly employed probability sampling techniques in Management research.

3.1.A Simple Random Sampling

Simple random sampling is the easiest form of probability sampling. All the researcher needs to do is assure that all the members of the population are included in the list and then randomly select the desired number of subjects. [3][1]

3.1.B Stratified Random Sampling

Stratified random sampling is also known as proportional random sampling. This is a probability sampling technique wherein the subjects are initially grouped into different classifications such as age, socioeconomic status or gender. Then, the researcher randomly selects the final list of subjects from the different strata. It is important to note that all the strata must have no overlaps. Researchers usually use stratified random sampling if they want to study a particular subgroup within the population.[3][1]

3.1.C Cluster Random Sampling

Cluster random sampling is done when simple random sampling is almost impossible because of the size of the population. In cluster sampling, the researcher first identifies boundaries of population. Then researcher randomly selects a number of identified areas. It is important that all areas within the population be given equal chances of being selected. The researcher can either include all the individuals within the selected areas or he can randomly select subjects from the identified areas.[1]

3.1.D Systematic Random Sampling

Systematic random sampling can be likened to an arithmetic progression wherein the difference between any two consecutive numbers is the same. Say for example we are in a clinic and we have 100 patients.

The first thing we do is pick an integer that is less than the total number of the population; this will be your first subject e.g. (3).Select another integer which will be the number of individuals between subjects e.g. (5).Then our subjects will be patients 3, 8, 13, 18, 23, and so on.[6]

3.2 Non-Probability Sampling

In this type of population sampling, members of the population

do not have equal chance of being selected. Due to this, it is not safe to assume that the sample fully represents the target population. It is also possible that the researcher deliberately chose the individuals that will participate in the study.

Non-probability population sampling method is useful for pilot studies, case studies, qualitative research, and for hypothesis development. This sampling method is usually employed in studies that are not interested in the parameters of the entire population. Some researchers prefer this sampling technique because it is cheap, quick and easy.[6]

Here we discuss some mostly employed Non-probability sampling techniques in Management research.

3.2.A Quota Sampling

Quota sampling is a non-probability sampling technique wherein the assembled sample has the same proportions of individuals as the entire population with respect to known characteristics, traits or focused phenomenon.[2]

In a study wherein the researcher likes to compare the academic performance of the different high school class levels, its relationship with gender and socioeconomic status, the researcher first identifies the subgroups. Usually, the subgroups are the characteristics or variables of the study. The researcher divides the entire population into class levels, intersected with gender and socioeconomic status. Then, he takes note of the proportions of these subgroups in the entire population and then samples each subgroup accordingly.

3.2.B Judgmental Sampling

Judgmental sampling is a non-probability sampling technique where the researcher selects units to be sampled based on their knowledge and professional judgment. This type of sampling technique is also known as purposive sampling and authoritative sampling.[4]

In a study wherein a researcher wants to know what it takes to graduate summa cum laude in college, the only people who can give the researcher first hand advise are the individuals who graduated summa cum laude. With this very specific and very

limited pool of individuals that can be considered as a subject, the researcher must use judgmental sampling.

3.2.C Convenience Sampling

Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher.[4]

One of the most common examples of convenience sampling is using student volunteers as subjects for the research. Another example is using subjects that are selected from a clinic, a class or an institution that is easily accessible to the researcher. A more concrete example is choosing five people from a class or choosing the first five names from the list of patients.

3.2.D Snowball Sampling

Snowball sampling is a non-probability sampling technique that is used by researchers to identify potential subjects in studies where subjects are hard to locate. Researchers use this sampling method if the sample for the study is very rare or is limited to a very small subgroup of the population. This type of sampling technique works like chain referral. After observing the initial subject, the researcher asks for assistance from the subject to help identify people with a similar trait of interest.[5]

IV. PROPOSED SYSTEM

In the above discussion, we focused on various sampling techniques as well as population in research. Aim of this article is to develop a system which guide or suggest an appropriate sampling technique to researcher based on his research objectives and study population(Target population).

Before suggesting the system let us focus on comparative analysis of various sampling techniques in sense that their Randomness , Homogeneity of data, Source of data, mathematical or inferential capabilities, Efficiency, Reliability, Precision etc.

| Sampling Methods | | Characteristics of sampling method | | | | | | | | | |
|----------------------------------|------------------------|------------------------------------|--|--------------------------------------|-----------------|------------------------|-------------------------------|------------|-------------|-----------|----------|
| | | Randomness | Homogeneity of Population or Sub-Populations (Strata or Cluster) | Source of data (Primary & Secondary) | Sampling Biased | Inferential Capability | Estimation of Sampling errors | Efficiency | Reliability | Precision | Accuracy |
| Probability Sampling Methods | Simple random sampling | | × | | × | | | low | low | low | |
| | Stratified sampling | | | | × | | | High | High | High | |
| | Cluster sampling | | | | × | | | High | High | High | |
| | Systematic sampling | | × | | × | | | low | low | low | |
| Non-Probability Sampling Methods | Quota sampling | × | | | | × | × | × | × | × | × |
| | Judgemental sampling | × | × | | | × | × | × | × | × | × |
| | Convenience sampling | × | × | | | × | × | × | × | × | × |
| | Snowball sampling | × | | | | × | × | × | × | × | × |

Table. 1. Comparison of sampling methods

4.1 Result

On the basis of comparative analysis we may interpret following results,

1. Simple random sampling provides completely random and heterogeneous data for investigation. Under this sampling researcher can use any source (i.e. Primary or Secondary) for data collection. The sample data obtained using SRS (with or without Replacement) neglects the heterogeneity in the population, so the degree of precision is relatively less and resultant sampling error is relatively more. Thus SRS is less efficient and quite low reliable probability sampling method than other probability sampling methods.

In stratified sampling and cluster sampling, population is divided into strata and cluster resp. because of heterogeneity of study

population. The only difference among strata and cluster is that strata's are internally homogeneous and may be heterogeneous among each other whereas clusters are internally heterogeneous and may be homogeneous among each other. Both sampling methods (Stratified & Cluster) takes care of the variability in population observations much better so sample obtained using these sampling methods is more representative and reliable. So, the degree of precision, efficiency, accuracy is likely to be high and resultant sampling error relatively less than SRS and Systematic sampling.

Systematic sampling is more simple and easy to adopt but many times it yields unrepresentative sample since probability of each sampling unit being included in the sample is either too high or too low.

2. In all the non-probability sampling methods discussed above, sample is selected on basis of purely subjective consideration such as personal judgment, experience, convenience. These methods neither guard against biases, nor do they permit estimation of sampling errors. So, these samples are unreliable and do not permit estimation of various characteristics of sample such as efficiency, precision, accuracy etc.

After the above discussion, we propose the following system (in two phases) which suggests or guide the researcher about the selection of proper sampling technique based on his research objectives and/or sampling objectives and study population.

4.2 Phase- I

Phase-I of the recommended system suggests user about the classifications of population under study and to adoption of Probability or Non-probability sampling technique based on his research objectives.

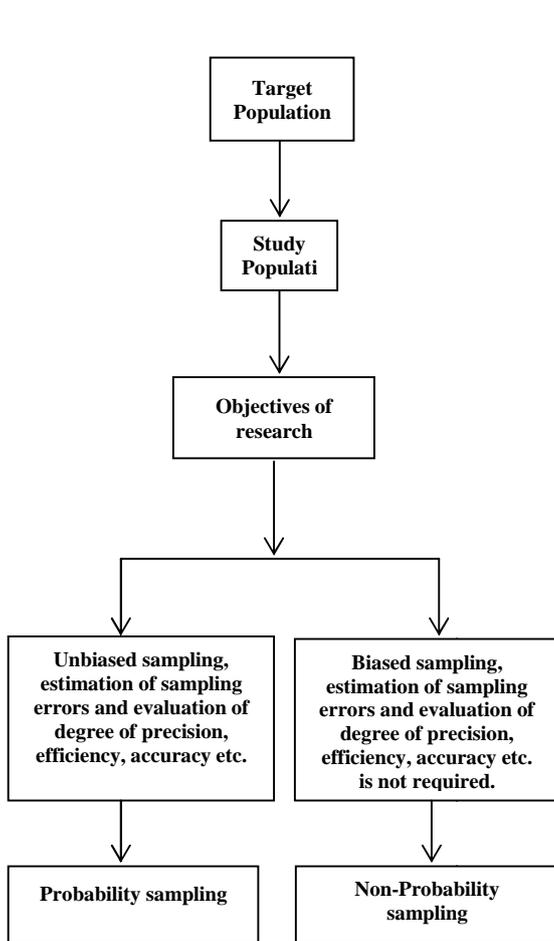


Fig. 4. Selection of sampling techniques based on research objectives.

4.3 Phase- II

Phase-II of the recommended system is divided in two sections based on sampling technique adopted by researcher in Phase-I. If researcher adopts Probability sampling in Phase-I then he proceed with section-1 of Phase-II i.e. Phase-II.1 and if researcher adopts Non-Probability sampling in Phase-I then he proceed with section-2 of Phase-II i.e. Phase-II.2.

4.3.A Phase-II.1.

This phase suggests user about adoption of appropriate Probability sampling technique based on his sampling objectives.

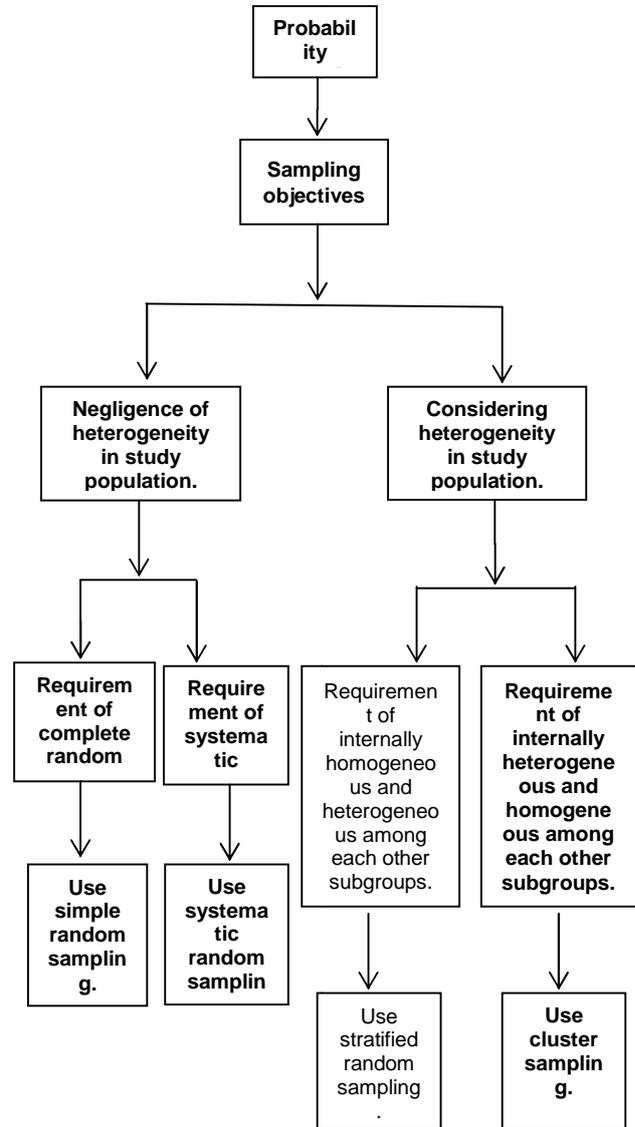


Fig. 5. Selection of probability sampling techniques based on sampling objectives.

4.3.B Phase-II.2.

This phase suggests user about adoption of appropriate Non-Probability sampling technique based on his sampling objectives.

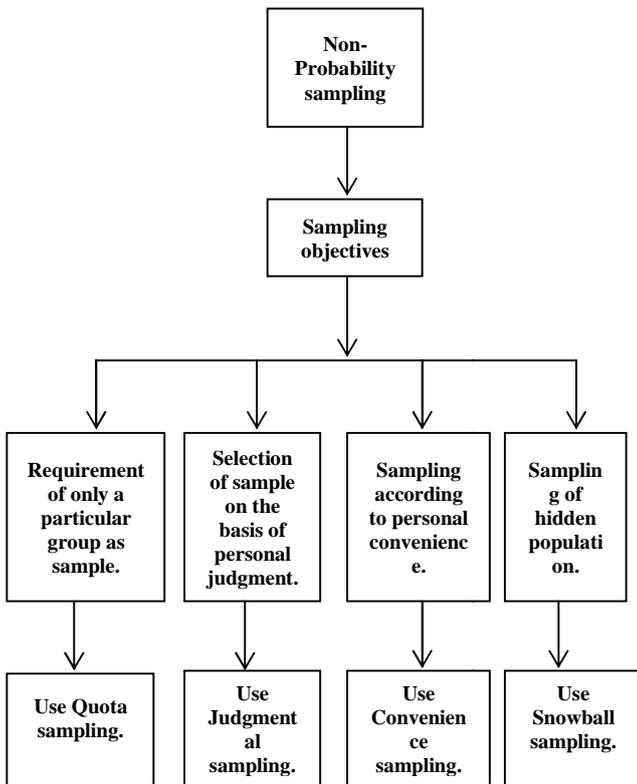


Fig. 6. Selection of non-probability sampling techniques based on sampling objectives.

V. CONCLUSION

In the present study, we focus on suggesting some guidelines to researchers about selection of a proper sampling technique. The present article helps various researchers in deciding their research as well as sampling objectives.

The modal proposed above will guide researchers in deciding the study population & its coverage, adoption of easy & reliable method of sampling based on their research objectives and study population.

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