
UNIT 3: SAMPLING DESIGNS

Structure

3.1 Introduction

3.2 Objectives

3.3 Importance of Selecting an Appropriate Sampling

3.4 Steps in Sample Design

3.5 Sampling Designs for Different Research

3.6 Sampling Design: Dos and Don'ts

3.7 Summary

3.8 Answers to Check Your Progress Exercises

3.9 References

3.10 Questions for Reflection and Practice



3.1 INTRODUCTION

When we decide to study a population, most often we are unable to look at all the individuals in the population. Real life issues like the lack of time, limited amount of money and inconvenience to the individuals under study disallow us to include the entire population in our study. Instead we choose a sample from the population, which reflects its structure and nature. We want our results to be reliable and dependable, and for those reasons our sample must represent the entire population. Choosing a right sample is a critical matter.

A sampling design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample. Sample design may as well lay down the number of items to be included in the sample i.e., the size of the sample. Sample design is determined before data are collected. There are many sample designs from which a researcher can choose. Some designs are relatively more precise and easier to apply than others. Researcher must select/ prepare a sample design which should be reliable and appropriate for the research study (Kothari 2004: 55).

When choosing a sample there are certain cautions that we must be aware of. As mentioned in the earlier Units, choosing a random sample is a very important matter. When we choose individuals randomly, we minimise bias. Samples are often biased when individuals volunteer themselves to be included in studies/experiments. In addition, favoritism of certain individuals over others, which in effect implies choosing a pre-selected group of individuals, can also yield results that will not reflect the characteristics of the overall population. In this Unit, we study the importance of choosing a right sample design in detail.

3.2 OBJECTIVES

After studying this Unit, you should be able to:

- Explain the importance of selecting appropriate sampling;
- List the steps in sample design;
- Describe the use of various sampling designs for different research; and
- Explain the dos and don'ts in sampling design

3.3 IMPORTANCE OF SELECTING AN APPROPRIATE SAMPLING

The sampling design is a fundamental part of data collection for scientifically based decision making. A well-developed sampling design plays a critical role in ensuring that data are sufficient to draw the conclusions needed. A sound, science-based decision is based on accurate information. For example, to collect accurate information about the level and reason of water contamination in a village, you should consider the following:

- Appropriateness and accuracy of the sample collection and handling method
- Effect of measurement error
- Quality and appropriateness of the laboratory analysis, and
- Representativeness of the data with respect to the objective of the study

Of these issues, representativeness is addressed through the sampling design. Representativeness may be considered as the measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Developing a sampling design is a crucial step in collecting appropriate and defensible data that accurately represent the problem being investigated.

In this example, assuming that good field and laboratory practices are exercised and adequate quality control is implemented, the analytical results of soil samples drawn from three randomly located sites may be representative if the objective is to identify whether a factory has released a particular contaminant. Random sampling locations should be generated from the entire part of the village. If a sampling design results in the collection of non-probability sample, even the highest quality laboratory analysis cannot compensate for the lack of representative data. The selection of the appropriate sampling design is necessary in order to have data that are representative of the problem being investigated (EPA 2002: 2-7).

To choose a sampling design that adequately addresses the estimation or decision at hand, it is important to understand what relevant factors should be considered and how these factors affect the choice of an appropriate sampling design.

3.4 STEPS IN SAMPLE DESIGN

While developing a sampling design, the researcher must pay attention to the following points:

- a. **Type of universe:** The first step in developing a sampling design is to clearly identify the universe to be studied. The universe can be finite or infinite. In finite universe the number of items is certain, for example number of workers in a factory, but in case of an infinite universe we do not know the total number of items, for example listeners of a radio programme.
- b. **Sampling unit:** A decision has to be taken concerning a sampling unit before selecting sample. Sampling unit may be a geographical one such as state, district, village, etc., or a social unit such as family, individual, school, etc. The researcher will have to decide one or more of such units that he has to select for this study.
- c. **Source list:** It is also known as sampling frame from which sample is to be drawn. It contains the names of all items of a universe. If source list is not available, researcher has to prepare it. The list should be comprehensive, reliable and appropriate. It is important to be as representative of the population as possible.
- d. **Size of sample:** This refers to the number of items to be selected from the universe to constitute a sample. Choosing the number is a major challenge before a researcher. The size of sample should neither be large, nor too small. The number should be optimum. While deciding the size of sample, researchers must determine the desired precision as also an acceptable confidence level for the estimate. The indicators of interest in a research study must be kept in view, while deciding the size of the sample. Also, the costs factor also kept in mind while choosing the size of sample.
- e. **Indicators to study:** In determining the sample design, one must consider the question of the specific population parameters which are of interest. For instance, you may be interested in estimating the proportion of persons with some characteristic in the population, or you may be interested in knowing some average or the other measure concerning the population. There may also be important sub-groups in the population about whom you would like to make estimates.
- f. **Financial constraints:** Cost considerations, from practical point of view, have a major impact upon decisions relating to not only the size of the sample but also to the type of sample.

- g. Sampling procedure: Finally, the researcher must decide the type of sample you will use i.e., you must decide about the technique to be used in selecting the items for the sample. In fact, this technique or procedure stands for the sample design itself. There are several sample designs out of which you must choose one for the study. You must select the sampling design which fulfils the sample size, within the cost and has a smaller sampling error.

Characteristics of a good sample design

A good sample design should have the following characteristics:

- Sample design must result in a truly representative sample
- Sample design must have small sampling error
- Sample design must be viable in the context of budget availability
- Sample design must be such so that systematic bias can be controlled
- Sample should be such that the results of the study can be generalised with a reasonable level of confidence (Kothari 2004: 56 – 58)

Check Your Progress Exercise 1

Note: i. Use this space given below to answer the question.

- ii. Compare your answer with the one given at the end of this Unit.

1. Explain the importance of choosing an appropriate sampling?

2. List seven steps in sample design.

3. What are the characteristics of a good sample design?

3.5 SAMPLING DESIGNS FOR DIFFERENT RESEARCH

Sampling procedures are used everyday. Market researchers use them to find out what the general population think about a new product or new advertisement. When they report that 87 per cent of the population like the smell of a new brand of washing soap, they haven't spoken to the whole population, but instead have contacted only a sample of people which they believe are able to represent the whole population.

There are two different types of sample designs namely, probability sampling and non-probability sampling. Probability sampling is based on the concept of random selection, whereas non-probability sampling is purposive sampling. In quantitative research, it is believed that if the sample is chosen carefully using the correct procedure, it is then possible to generalise the results to the whole of the research population. In qualitative research the ability to generalise their work to the whole research population is not the goal. Instead, they might seek to describe or explain what is happening within a smaller group of people.

Sample size

The first question researchers tend to ask is 'how many people should I choose for the sample?' This obviously depends on the type of research. For quantitative research, you will need to contact many more people than you would for a small, qualitative piece of research.

The sample size will also depend on what you want to do with your results. If you intend to produce large amounts of cross tabulations, the more people you contact the better.

It tends to be a general rule in quantitative research that the larger the sample the more accurate your results. However, you have to remember that you are probably restricted by time and money – you have to make sure that you construct a sample which will be manageable. Also, you have to account for non-response and you may need to choose a higher proportion of your research population.

Use of Probability Vs. Non-probability Sampling in Research Studies

The best way to illustrate probability and non-probability sampling methods is to take one issue and show how the focus of the research and the methodology leads to the use of different sampling methods. The area of research is ‘corporal punishment’ and in the following table you can see that the focus and sampling techniques within this topic can be very different, depending on the preferences of the researcher, the purpose of the research and the available resources.

No	Probability Samples	Non-probability Samples
1	The researcher is interested in finding out about national corporal punishment rates. He wants to make sure that every school in the country has an equal chance of being chosen because he hopes to be able to make generalisations from his findings. He decides to use a simple random sample. Using this method the researcher needs to obtain the name of every school in the country. Numbers are assigned to each name and a random sample generated by computer. He then sends a questionnaire to each of the selected schools. The researcher would have to make sure that he	The researcher decides that he wants to interview a sample of all pupils within a school, regardless of whether they have been on corporal punishment or not. He decides to use a quota sample to make sure that all groups within the school are represented. He decides to interview a specified number of female and male school pupils, a specified number of arts, sciences and social science pupils and a specified number within different age categories. He continues approaching students and interviewing them until his quota is complete. By using this method

	obtained the name of every school in the country for this method to work properly.	only those pupils present at the same time and in the same place as the researcher have a chance of being selected.
2	The researcher wants to find out about national corporal punishment rates, but is interested also in finding out about school policy concerning corporal punishment. He decides that to do this he needs to visit each selected school. To cut down on travel costs, he decides to use a cluster sample. Using this method, geographical 'clusters' are chosen and a random sample of schools from each cluster is generated using random number tables found at the back of some statistics books. Using this method the researcher only needs to travel to schools within the selected geographical regions. The researcher would have to make sure that he chose his clusters very carefully, especially as policy concerning corporal punishment might vary between regions.	The researcher is interested in carrying out semi-structured interviews with pupils who have been on corporal punishment over the past year. However, he finds that the school has not kept accurate records of these pupils. Also, he doesn't want to approach the school because he will be seen by the pupils as an authority figure attached to the school. He decides that a snowball sample would be the most appropriate method. He happens to know a pupil who has been on corporal punishment recently and so speaks to her, asking for names of other pupils who might be willing to talk to him. The researcher should obtain permission and have a chaperone or guardian present at the interviews. He needs to be aware also that friends tend to recommend friends, which could lead to sampling bias.
3	The researcher has decided that he wishes to conduct a structured interview with all the children who have been on corporal punishment within a year at one school. With the head teacher's permission, he obtains a list of all these pupils. He decides to use a quasi-random sample or systematic sample. Using this method he chooses a random point on the list and then every third pupil is selected. The problem with	The researcher has heard of a local school which has very few corporal punishments, despite that school having a corporal punishment policy. He decides to find out why and visits the school to speak to the head teacher. Many interesting points arise from the interview and the researcher decides to use a theoretical sampling technique. Using this method the emerging theory helps the

	<p>this method is that it depends upon how the list has been organised. If, for example, the list has been organised alphabetically, the researcher needs to be aware that some cultures and nationalities may have family names which start with the same letters. This means that these children would be grouped together in the list and may, therefore, be underrepresented in the sample.</p>	<p>researcher to choose the sample. For example, he might decide to visit a school that has a high corporal punishment rate and a school that has no corporal punishment policy, all of which will help to explain differing corporal punishment rates and attitudes towards them. Within this sampling procedure, he might choose to sample extreme cases which help to explain something, or he might choose heterogeneous samples where there is a deliberate strategy to select people who are alike in some relevant detail. Again the researcher has to be aware of sampling bias.</p>
4	<p>The researcher has decided that he wishes to concentrate on the corporal punishment rates of pupils by subject choice and so decides upon a stratified random sample. Using this method the researcher stratifies his sample by subject area and then chooses a random sample of pupils from each subject area. However, if he found that there were many more pupils in the arts than the sciences, he could decide to choose a disproportionate stratified sample and increase the sample size of the science pupils to make sure that his data are meaningful. The researcher would have to plan this sample very carefully and would need accurate records of subjects and pupils.</p>	<p>The researcher is a teacher himself and decides to interview colleagues, as he has limited time and resources available to him. This is a convenience sample. Also, at a conference he unexpectedly gets to interview other teachers. This might be termed haphazard or accidental sampling. The ability to generalise from this type of sample is not the goal, and, as with other sampling procedures, the researcher has to be aware of bias which could enter the process. However, the insider status of the teacher may help him to obtain information or access which might not be available to other researchers.</p>

Check Your Progress Exercise 2

Note: i. Use this space given below to answer the question.

ii. Compare your answer with the one given at the end of this Unit.

1. As a researcher, how would you find out the national corporal punishment rates?

3.6 SAMPLING DESIGN: DOS AND DON'TS

From a brief description of the various sample designs presented above, we can say that normally one should resort to probability sampling because under it bias is generally eliminated and the sampling error can be estimated. But non-probability sampling is considered more appropriate when the universe happens to be small and a know characteristic of it is to be studied intensively. There are situations in real life under which sample designs other than simple random samples may be considered better and as such the same may be used. In a situation when random sampling is not possible, then we have to use necessarily a sampling design other than random sampling. At times, several methods of sampling may well be used in the same study. There are dos and don'ts of sampling and they are listed below:

Do

- Take time and effort to work out your sample correctly if you're conducting a large scale survey. Read the relevant literature suggested in this book. Time taken at the beginning will save much wasted time later.
- Discuss your proposed sampling procedure and size with your tutor, boss or other researchers.
- Be realistic about the size of sample possible on your budget and within your time scale.

- Be open and up front about your sample. What are your concerns? Could anything have been done differently? How might you improve upon your methods?
- Use a combination of sampling procedures if it is appropriate for your work.

Don't

- Rush into your work without thinking very carefully about sampling issues. If you get it wrong it could invalidate your whole research.
- Ignore advice from those who know what they're talking about.
- Take on more than you can cope with. A badly worked out, large sample may not produce as much useful data as a well-worked out, small sample.
- Make claims which cannot be justified nor generalised to the whole population.
- Stick rigorously to a sampling technique that is not working. Admit your mistakes, learn by them and change to something more appropriate

Check Your Progress Exercise 3

Note: i. Use this space given below to answer the question.

ii. Compare your answer with the one given at the end of this Unit.

1. List the Dos and Don'ts of sampling design?

3.7 SUMMARY

Some of the key learning from this Unit are:

- If it is not possible to contact everyone in the research population, researchers select a number of people to contact. This is called sampling.

- There are two main types of sampling category – probability samples and purposive samples.
- In probability samples, all people within the research population have a specifiable chance of being selected. Only within random samples do participants have an equal chance of being selected.
- Purposive samples are used if generalisation is not the goal.
- The size of sample will depend upon the type and purpose of the research.
- Sample sizes should take into account issues of non-response.
- Remember that with postal surveys it might be difficult to control and know who has filled in a questionnaire. Will this affect your sample?
- In some purposive samples it is difficult to specify at the beginning of the research how many people will be contacted.
- It is possible to use a mixture of sampling techniques within one project which may help to overcome some of the disadvantages found within different procedures.

3.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISE

Check Your Progress Exercise 1

1. Explain the importance of choosing an appropriate sampling?

The sampling design is a fundamental part of data collection for scientifically based decision making. A well-developed sampling design plays a critical role in ensuring that data are sufficient to draw the conclusions needed. A sound, science-based decision is based on accurate information. For example, to collect accurate information about the level and reason of water contamination in a village, you should consider the following:

- Appropriateness and accuracy of the sample collection and handling method
- Effect of measurement error
- Quality and appropriateness of the laboratory analysis, and
- Representativeness of the data with respect to the objective of the study

2. List seven steps in sample design.

While developing a sampling design, the researcher must pay attention to the following points:

1. Type of universe
3. Sampling unit
3. Source list
4. Sample size
5. Indicators to study
6. Financial constraints
7. Sampling procedure

3. What are the characteristics of a good sample design?

A good sample design should have the following characteristics:

- Sample design must result in a truly representative sample
- Sample design must have small sampling error
- Sample design must be viable in the context of budget availability
- Sample design must be such so that systematic bias can be controlled
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Check Your Progress Exercise 2

1. As a researcher, how would you find out the national corporal punishment rates?

The researcher is interested in finding out about national corporal punishment rates. He wants to make sure that every school in the country has an equal chance of being chosen because he hopes to be able to make generalisations from his findings. He decides to use a simple random sample. Using this method the researcher needs to obtain the name of every school in the country. Numbers are assigned to each name and a random sample generated by computer. He then sends a questionnaire to each of the selected schools. The researcher

would have to make sure that he obtained the name of every school in the country for this method to work properly.

Check Your Progress Exercise 3

1. List the Dos and Don'ts of sampling design?

There are dos and don'ts of sampling and they are listed below:

Do

- Take time and effort to work out your sample correctly if you're conducting a large scale survey. Read the relevant literature suggested in this book. Time taken at the beginning will save much wasted time later.
- Discuss your proposed sampling procedure and size with your tutor, boss or other researchers.
- Be realistic about the size of sample possible on your budget and within your time scale.
- Be open and up front about your sample. What are your concerns? Could anything have been done differently? How might you improve upon your methods?
- Use a combination of sampling procedures if it is appropriate for your work.

Don't

- Rush into your work without thinking very carefully about sampling issues. If you get it wrong it could invalidate your whole research.
- Ignore advice from those who know what they're talking about.
- Take on more than you can cope with. A badly worked out, large sample may not produce as much useful data as a well-worked out, small sample.
- Make claims which cannot be justified nor generalised to the whole population.

Stick rigorously to a sampling technique that is not working. Admit your mistakes, learn by them and change to something more appropriate.

3.9 REFERENCES

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3.10 QUESTIONS FOR REFLECTION AND PRACTICE

1. What do you mean by Sample Design?.
 2. What points should be taken into consideration by a researcher in developing a sample design?
 3. Why probability sampling is generally preferred in comparison to non-probability sampling?
 4. What are the dos and don'ts of sampling?
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