UNIT 3 RESEARCH DESIGN

Structure

3.1 INTRODUCTION

The Unit 'Research Design' brings forth various phases of research that could be carried out in a planned and phased manner by developing a research design. Once the researcher finalizes the research design, the entire research process will be under their control. The example below will make learners realize the significance of developing a research design. The architect prepares the design, keeping in mind that he needs to construct a building. The plan will contain the structure of the building, number of rooms, utilization of rooms, size of open space, size of garden space, building material, and length and breadth of the building in square feet. The architect will decide and prepare a blueprint or plan before starting the building. I believe the above example will help you know the research design's significance.

Once the design is in the hands of the researcher, they have the freedom to make necessary changes whenever the need arises. Designing also helps the researcher reduce wasteful expenditure on finance, time and energy. The process of preparing a research design anticipates various difficulties, and the same difficulties will be addressed in the research design through appropriate strategies. Preparing the research design also helps the researcher to control

the unexpected situation rationally. It also facilitates the researcher to articulate the research procedure in a better manner during the academic presentation. It helps them to prevent the possibility of failure. With the above introduction, the present unit facilitates you to learn the definition and need for research design, principles of design research design, and types of research designs. Finally, we discuss sampling techniques.

3.2 OBJECTIVES

After studying this unit, you should be able to

- define research design;
- discuss the need for the research design;
- explain various research designs;
- define sampling;
- discuss the need for sampling; and
- describe various sampling techniques.

3.3 NEED FOR RESEARCH DESIGN

Let us start with defining "what is Research Design". We define the research design as "such design as a symbolic construction or model". "The research design is the arrangement of conditions for data collection and analysis in a manner that aims to combine relevance to the research purpose with the economy in procedure" (Selltiz et al. 1964). If we look at the above definition, we can see that the design talks explicitly about the research objectives, the rationale for doing specific research, and a methodology which includes methods and theory, sampling, data and data organization. Besides the core procedures mentioned above, scientific research design must explicitly describe the accepted methodology. The theory must be a core component of the social science research design. The research design should have the following aspects.

1. The details of the study
2. The rationale for choosing the study
3. Reasons for carrying out the study
4. Type of data required for the chosen study
5. Techniques of data collection
6. Area of Study
7. The period of study
8. Duration of the study
9. Requirements of different types of material for the research study
10. Tools and techniques required for the study
11. Selection of cases, number of cases required for the study
12. Methods of data analysis

The above-said points need to be addressed in a structured manner with clarity in the research design. Once the researcher addresses the above points in the research design, they could achieve the research objectives with minimum expenditure.

1. Let us discuss the need for methodologically designed research in the following paragraph. We will draw the need for research design through an example. Once the researcher formulates research questions and objectives, the researcher has no idea how accurate the results of his study are in many cases. Of course, the researchers may have many questions in their minds and try to inquire. One takes up research to make a valuable contribution to the community and further scientific inquiry. In such a situation, the researcher has to find out how much percentage of inaccuracy can be accepted. Secondly, researchers need to know how much percentage inaccuracy will be produced by/her methods or instruments. In both situations, if a researcher gets clarity, there is no need to trouble themselves by wasting time and energy to get more incredible accuracy.

2. In every research, the collected data must be in a tabular format that needs to be analysed. The collected data should be meaningfully presented to interpret and draw conclusions. The researchers may not get good results if they take lots of time to collect more unwanted data. Most of the time, the researcher intends to collect new data. If researchers have lots of data without understanding how they will give meaning to that data after spending so much time collecting it, the data does not give any meaning to their research. It is too late to give meaning to them at the final stage of the research. The above-mentioned hypothetical situation can be avoided by taking the time to prepare the research design. In laboratory research, the researcher may wish to do impressive research. At the same time, if they develop inferior quality instruments to experiment, they may get inaccurate results. At the same, if the researcher devotes his energy and time to developing quality instruments to do testing, he may get accurate results.

3. As a scientist, it is their responsibility to build scientific institutions with their capability for a better way of inquiry. They may apply various methodological inquiries to build theories to solve societal problems and inquire about social relations. A scientist cannot afford to satisfy with his methods. As a scientist, it is their responsibility to question every stage of their research by questioning their methods with an open mind. This paves the way for improving their methods continuously while doing the research. Once the researcher decides on the research problem, they must develop an appropriate methodology to solve the problem. In this process, developing a research design is very important. According to Ackoff, “the idealized research design is concerned with specifying the optimum research procedure that could be followed where there are no practical restrictions”.

If you look at the above definition of research design, it states that there is no need to develop an idealized research design. One can give a choice to improve the research design in the process of conducting the research. Once the researcher finalized the research design, it must be converted into the working procedure. Before starting the research, the researcher must consider various factors, including time, money and energy.

4. If research is part of the master's or pre-PhD programme, the researcher may face time constraints. In such a situation, the researcher may limit to observing one or two variables rather than finalizing multiple variables to observe. The observation method may bring subjective error in both science and social science research. In such a situation, the researcher may consider using triangulation as a method where the same phenomena can be tested using more than one method. The researcher needs to collect data using more than one method as this may also, in some situation, helps in avoiding errors in collecting the data. They may draw a sampling population that they need to observe multiple times. Sometimes this may take time and energy, which is not practical. Thus, the research design helps the researcher to organize his ideas in a form whereby it will be possible for them to look for flaws and inadequacies. The research design also allows researchers to present their study to the experts for critical comments and evaluation. Without such a course of action, it will be difficult for the critic to provide a comprehensive review of the proposed study.

3.4 PRINCIPLES OF RESEARCH DESIGN

The following principles must be kept in mind while designing the research—the existing literature mentioned the following six principles for research design.

1. Research design should be holistic.
2. It should be agnostic.
3. It should be prepared with a purpose.
4. The research design should be prepared early.
5. It should be flexible.
6. It should be shared with experts and other researchers.

3.5 TYPES OF RESEARCH DESIGNS

According to Manheim, there are three types of research designs.

1. Research design in case of exploratory research studies;
2. Research design in case of descriptive and diagnostic research studies, and

3. Research design in case of hypothesis-testing research studies.

Let us discuss each type of research in detail in this section.

1. Research Design in case of Exploratory Research Studies

It is also called formulative research studies. The study based on exploratory research design is either to formulate a research problem for further precise investigation or to develop a working hypothesis for further research. The following example will help you to know exploratory research with clarity. A person has visited a doctor with a fever. The doctor did not know the reasons for his/her fever. The doctor might treat the patient with the visible symptoms. If the fever went within a few days, the doctor diagnosed it rightly and treated for the disease the doctor diagnosed by giving drugs based on visible symptoms. His exploration of particular patients for visible symptoms might pave the way for knowing symptoms of malaria or dengue, facilitating further research on symptoms and drugs. With the above example, the research design emphasizes discovering ideas and insights. As I mentioned in an example in this section, exploratory research design provides space and flexibility to explore different aspects of a specific research problem. In the initial stage, the research problem will be defined. It will be converted into a specific research problem after exploratory studies. In the exploratory research design, there will be flexibility in changing the research design. In exploratory research design, the following research is mainly carried out.

1. Reviewing existing literature for chosen research problem;
2. The experience survey to document the experiences of individuals on specific issues; and
3. The analysis of 'insight-stimulating' examples.

The survey of an existing literature review may pave the way for formulating particular research problems or developing hypotheses. It is a simple and fruitful method. The researchers need to visit libraries to review the existing literature. The existing studies and the hypotheses stated in the existing studies may be reviewed, and their usefulness is evaluated. Based on that, further research for formulating research problems may be planned. It may also be considered whether the already stated hypotheses suggest a new hypothesis. In this way, the researcher reviews and builds upon their work based on the work done by others. However, in cases where hypotheses have not been formulated, her/his task is to review the available material for deriving the relevant hypotheses. Besides, the bibliographical survey of studies already made in one's area of interest may also facilitate the researcher to formulate the problem precisely. Researchers should also attempt to apply concepts and theories developed in different research contexts to the area in which they are working. Sometimes the works of creative writers also provide a fertile ground for hypothesis formulation.

Experience survey means surveying people with practical experience with a specific problem to be studied. Such a survey aims to obtain insight into the

relationships between variables and new ideas relating to the research problem. For such a survey, competent people can contribute new ideas. The sample population to explore new ideas may be selected carefully. Researchers must ensure that respondents represent different types of experience. The investigator may then interview the selected respondents. The researcher must prepare an interview schedule for the systematic questioning of informants. However, the researcher must ensure flexibility in conducting interviews because the respondents should be allowed to raise issues and questions that the investigator has not previously considered. Generally, collecting information through their experiences in an interview is likely to be long and may last a few hours. Hence, it is often considered desirable to send a copy of the questions to be discussed to the respondents well in advance. This will also allow the respondents to do some advance thinking over the various issues involved so that, at the time of the interview, they may be able to contribute effectively. Thus, an experience survey may enable the researcher to define the problem more precisely and help formulate the research hypothesis. The survey may also provide information about the practical possibilities for doing different types of research.

Analysis of 'insight-stimulating' examples is also a fruitful method for suggesting hypotheses for research. It is particularly suitable in areas with little experience as a guide. This method consists of intensively studying selected instances of the phenomenon in which one is interested. For this purpose, the existing records may be examined, unstructured interviewing may take place, or any other approach may be adopted. The investigator's attitude, the study's intensity and the researcher's ability to draw diverse information into a unified interpretation are the main features that make this method an appropriate procedure for evoking insights.

Now, what sort of examples are to be selected and studied? There is no clear-cut answer to it. Experience indicates that certain types of instances are more appropriate for particular problems than others. One can mention a few examples of 'insight-stimulating' cases such as the reactions of strangers, the reactions of marginal individuals, the study of individuals who are in transition from one stage to another, and the reactions of individuals from different social strata and the like. Thus, in an exploratory formulative research study which merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only thing essential is that it must continue to remain flexible so that many different facets of a problem may be considered as and when they arise and come to the notice of the researcher.

2. Research Design in case of Descriptive and Diagnostic Research Studies

The researcher will decide to do descriptive research studies to describe the characteristics of a particular individual or a group. Unlike descriptive studies, diagnostic research studies determine the frequency with which something occurs or its association with something else—the studies

concerning whether certain variables are associated are examples of diagnostic research studies. For example, the world has faced the Covid 19 pandemic, which made it standstill. The diagnostic research may determine the frequency and interval of a pandemic from the 19th century. As against this, studies concerned with specific predictions, with the narration of facts and characteristics concerning individuals, groups, or situations are all examples of descriptive research studies. Most of the social research comes under this category. From the point of view of the research design, the descriptive and diagnostic studies share common requirements. We may group these two types of research studies. In descriptive and diagnostic studies, the researcher must clearly define what he wants to measure and find adequate methods for measuring it along with a clear-cut definition of the 'population' he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure must be carefully planned. The research design must protect against bias and maximize reliability, with due concern for the economical completion of the research study. The design in such studies must be rigid and not flexible. It must focus attention on the following: (a) Formulation of the objective of the study, (b) finalization of methods of data collection, (c) Selecting the sample, (d) Collection of data, (e) Processing and analysing the data. (f) Reporting the findings. The first step in a descriptive/diagnostic study is to specify the objectives after stating the research question(s).

The researcher may encourage using "structured instruments" to reduce biases. The sample design is significant in this type of research design. We have discussed different sample designs in this unit. The researcher must ensure that the selection of the sample must be error-free. It is suggested to design sampling through probability or random sampling. To obtain data free from errors introduced by those responsible for collecting them, it is necessary to closely supervise the field workers' staff as they collect and record information. Checks may be set up to ensure that the data collecting staff perform their duty honestly and without prejudice. "As data are collected, they should be examined for completeness, comprehensibility, consistency and reliability. The data collected must be processed and analysed. This includes coding the interview replies and observations, tabulating the data, and performing several statistical computations. To the extent possible, the processing and analysing procedure should be planned in detail before actual work is started. This will prove economical because the researcher may avoid unnecessary labour. Coding should be done carefully to avoid coding errors.

Similarly, the accuracy of tabulation may be checked by having a sample of the tables re-done. In the case of mechanical tabulation, the material (i.e., the collected data or information) must be entered on appropriate cards, which is usually done by punching holes corresponding to a given code. The accuracy of punching is to be checked and ensured. Finally, statistical computations are needed, so averages, percentages, and various coefficients must be worked out. Probability and sampling analysis may as well be used. The

appropriate statistical operations and tests of significance should be carried out to safeguard the drawing of conclusions concerning the study. Lastly, the completed research must be appropriately communicated through well-written reports. The report's structure needs to be well planned so that all things relating to the research study may be well presented in a simple and practical style. Thus, the research design in the case of descriptive/diagnostic studies is a comparative design throwing light on all points narrated above and must be prepared to keep in view the objective(s) of the study and the resources available. However, it must ensure the collected evidence's minimization of bias and reliability. The said design can be appropriately referred to as a survey design since it considers all the steps involved in a survey concerning a phenomenon to be studied.

3. Research Design in case of Hypothesis-testing Research Studies

It is generally called experimental studies. This research study tests the relationship between two or more variables. In this experimental design, the researcher first finalizes the experimental procedure to reduce bias and ensure reliability and validity. After completing the experiment, the researcher could infer the results about causality.

Experimental design is conducting research in an objective and controlled fashion so that precision is maximized and specific conclusions can be drawn regarding a hypothesis statement. Generally, the purpose is to establish a factor or independent variable's effect on a dependent variable. Thus, in an experiment, we observe and measure the effect of treatment given to a few variables by controlling other variables affecting our observations. The term “treatment” refers to a particular experimental condition. The material to which the treatment is applied and on which the variable under study is measured is known as the experimental unit. Since all variables cannot be controlled, it may cause an error in our observations. It is an experimental error. The whole experiment is conducted according to some plan called the experiment or experimental design. Without a design, a research study is like a construction without any plan or map. The design enables us to answer research questions as validly, objectively, precisely and economically as possible.

The principles of experimental design play an essential role in research. Professor R.A. Fisher’s name is associated with experimental designs. He made the beginning of such designs in agricultural research. As such, the study of experimental designs has its origin in agricultural research. Professor Fisher found that by dividing agricultural fields or plots into different blocks and conducting experiments in each block, whatever information is collected and inferences are drawn from them is more reliable. This fact inspired him to develop specific experimental designs for testing hypotheses concerning scientific investigations. Today, experimental designs are being used in research relating to phenomena of several disciplines. Since experimental designs originated in the context of agricultural operations, we still use

several technical terms of agriculture (such as treatment, yield, plot, block) in experimental designs.

Basic Principles of Experimental Designs

Professor Fisher has enumerated three principles of experimental designs:

(1) Principle of Replication;

(2) Principle of Randomization; and

(3) Principle of Local Control.

1. Principle of Replication

The experiment should be repeated more than once to increase the statistical accuracy. Each treatment is applied in many experimental units instead of one. For example, if we need to compare the yield of two varieties of paddy, then each variety is applied to more than one experimental unit. The number of times these are applied to experimental units is called their number of replications.

2. **Principle of Randomization**

The principle of Randomization involves allocating experimental units at random to avoid any bias resulting from the influence of some unknown extraneous factor that may affect the experiment. In the analysis of variance, we assume that the errors are random and independent. In turn, the observations also become random. The principle of randomization ensures this. It eliminates the systematic bias. "Randomization is analogous to insurance in that it is a precaution against disturbances that may or may not occur, and that may or may not be serious.

3. **Principle of Local Control**

The third principle is called local or error control. As already mentioned, replication with local control reduces the experimental error. In the simplest case, experimental units are divided into homogenous groups. The variation among these groups is eliminated from the error, thereby increasing efficiency. The choice of size and shape of experimental units, and environmental conditions, also affect the experiment, causing errors. It may be controlled by using an analysis of co-variance also.

Local control helps in controlling the systematic error or general factors or say "G" error; Randomization controls the sampling error or "S" error and also a little "G" error. Replication mainly controls the variations in treatment effects. Let us call it an "R" error. Measurement error is controlled by replication. Replication with randomization would be able to control all three errors and the "G" error and measurement error with local control. So, replication is a fundamental principle. Experimental design refers to the framework or structure of an experiment, and as such, there are several experimental designs. We can classify experimental designs into two broad

categories: informal experimental and formal experimental designs. Informal experimental designs are those designs that generally use a less sophisticated form of analysis based on differences in magnitudes. In contrast, formal experimental designs offer relatively more control and use precise statistical procedures for analysis. Important experiment designs are as follows:

(a) Informal Experimental Designs:
    (i) Before-and-after without control design
    (ii) After-only with control design
    (iii) Before-and-after with control design

(b) Formal Experimental Designs:
    (i) Completely Randomized Design (CRD)
    (ii) Randomized Block Design (RBD)
    (iii) Latin Square Designs (LSD)
    (iv) Factorial Designs

Before-and-after without control design: In such a design, a single test group or area is selected, and the dependent variable is measured before the introduction of the treatment. The treatment is then introduced, and the dependent variable is measured again. The effect of the treatment would be equal to the level of the phenomenon after the treatment minus the level of the phenomenon before the treatment.

After only with control design: In this design, two groups or areas (test area and control area) are selected, and the treatment is introduced into the test area only. The dependent variable is then measured in both areas at the same time. Treatment impact is assessed by subtracting the value of the dependent variable in the control area from its value in the test area.

Before-and-after with control design: In this design, two areas are selected, and the dependent variable is measured in both areas for an equal period before the treatment. The treatment is then introduced into the test area only, and the dependent variable is measured in both for an identical period after the introduction of the treatment. The treatment effect is determined by subtracting the change in the dependent variable in the control area from the change in the dependent variables in the test area.

Completely Randomized Design (CRD): CRD involves only two principles, viz., the principle of replication and the principle of randomization of experimental designs. It is the most uncomplicated possible design, and its analysis procedure is also more effortless. The essential characteristic of the design is that subjects are randomly assigned to experimental treatments or vice-versa.

Randomized Block Design (RBD) is an improvement over the CRD. In the RBD, the principle of local control can be applied along with the other two principles of experimental designs. The variable selected for grouping the

subjects is believed to be related to the measures obtained in respect of the dependent variable.

Latin Square Design (LSD) is an experimental design very frequently used in agricultural research. The conditions under which agricultural investigations are carried out differ from those in other studies, for nature plays an essential role in agriculture.

Factorial Designs: Factorial designs are used in experiments where the effects of varying more than one factor are to be determined. They are significant in several economic and social phenomena where many factors usually affect a particular problem. Factorial designs can be of two types: (i) simple factorial designs and (ii) complex factorial designs.

3.6 DEVELOPING A RESEARCH PLAN-EXPLORATION, DESCRIPTION, DIAGNOSIS AND EXPERIMENTATION

The entire research process starts with identifying the research problem. Once the researcher identifies the research problem, the researcher must organize their thoughts in a specific order, and he needs to define the terms related to the research. They may use existing definitions for the terms or define them. The researchers thought need to be converted as a 'Research Plan'. Converting the researcher's ideas into a specific research plan will help the researcher

structure in the following manner.

1. Experts, in particular, may provide suggestions to do research after looking at the proposal. Thus, the researcher could be able to rectify flaws in the research design.
2. It facilitates the researcher to focus on a review of the literature.
3. The research plan starts with a short introduction, research question, objectives, definitions for the concepts, methodology, experimental procedure (if it is experimental research), and theory (if it is social science research). The methodology includes sampling methods, data collection tools and technology, statistical procedure to analyse data and the of the research report.
4. The research plan also contains the time and cost of the study.

3.7 SAMPLING TECHNIQUES

As we mentioned earlier, sampling is an effective research technique as part of the research process. There are various terms related to sampling. We will explain those terms in this section, along with types.

First, we will learn the term 'Universe/Population'. All items in any field of inquiry constitute a 'Universe' or 'Population.' A complete enumeration of all items in the 'population' is known as a census inquiry. You all must be

heard about the census survey of India. The government of India conducted a census survey once in 10 years to generate complete data on population and related indicators. The collected data from all populations in India will be tabulated under various heads, and the researcher may find these data useful for their research to bring certain inferences. However, it needs to be emphasized that when the Universe is small, there is no use in adopting a sample survey. At the same time, when field studies are undertaken in practical life, considering time and cost, we have to select respondents, i.e., selecting only a few items. The selected respondents should be as representative of the total population as possible to produce a miniature cross-section. The selected respondents are called a ‘sample', and the selection process is called the 'sampling technique.' The survey so conducted is known as a ‘sample survey’. The researcher must prepare a sample design for his study, i.e., plan how a sample should be selected and what size such a sample would be.

Sample Designs

The researcher needs to finalize the size of the sample for the study. The finalization of several items to be included in the sample, i.e., the sample size. The selection of the size of the sample is called sample design. The researcher needs to finalize the sample size before proceeding with data collection.

There are two ways of selecting the sample: probability and non-probability. The learners need to understand the fundamental difference between probability and non-probability sampling before we proceed further. First, let us learn what probability is. You all must have learned the definition of probability in the mathematics and statistics courses. If one is unsure about something, does not have enough information, and can only guess in the process of guessing, there is uncertainty about the future course of action.

In daily life, we may face lots of uncertain situations. We always try to think that a particular situation may come or may not. In this situation, the concept of probability gives us a hand to answer a question like what is the likelihood that X will win the election or “A” team will win the match? It is illustrative of the concept of probability. If the chance of winning is one in five, the probability is 1/5 =0.2. If the chances are 1 in 100, the probability is 0.01.

3.8 NEED FOR SAMPLING

Due to various reasons (including limited period and limited resources), it may not be possible for the researcher to include the entire population in survey research. Thus, they select a part of the population to understand the characteristics of a population.

The process of systematically selecting cases from the population or Universe is called sampling. Thus, a researcher gets a set of cases (or a sample) that is more manageable and cost-effective to work with those cases to bring scientific inferences.

The next question is, how we can generalize from a handful of cases? Here we need to research logically with statistical reasoning, testing repeatedly with empirical evidence. Moreover, a researcher cannot use just any sample for generalization. Well-laid down sampling procedures require rigorous exercises to increase a study's precision level.

3.9 SIGNIFICANT TERMS IN SAMPLING

Let us learn about essential terms in sampling

1. Sampling Ratio

The ratio of the size of the sample to the size of the target population is the 'sampling ratio'. For example, a college has 2000 students, and a researcher draws a sample of 200 from it. Thus, the sampling ratio is 200/2000 = 0.1, or 10 per cent.

2. Sampling Frame

A population is an abstract concept. Except for specific small populations, one can never indeed freeze a population to measure it. For example, in a city, at any given moment, some are born, some may leave the city, some may join the city as new entrants, and some may lose their life. The researcher must decide exactly whom to count. Should she or he count a city resident on holiday or outside the city when the time is fixed for the study? Therefore, the notion of 'population' is abstract and exists in the mind but is impossible to pinpoint concretely. Since it is an abstract concept, except for small populations, a researcher needs to estimate the population. Thus, it requires an operational definition.

A researcher operationalizes a population by developing a specific list that closely approximates all the elements in the population. This list is a 'sampling frame'. The researcher may choose from many sampling frames: telephone directories, driving licences, ration cards, membership in a club, and students' registration in a university. A reasonable sampling frame is crucial to good sampling. A mismatch between the sampling frame and the conceptually defined population can be a significant source of error. For instance, if you select the telephone directory as a sampling frame, it constitutes only 5-10 per cent of the population in a city, say, Delhi. The directory does not list those who do not have a telephone connection. It also does not update the frequent shifts of residences and changes in telephone numbers in a city quickly.

3. Parameter and Statistic

Any characteristic of a population is a 'population parameter'. For instance, students from the science stream of children aged 6-11 years. It is the true characteristic of the population. Parameters are determined when all elements in a population are measured. The parameter is never known with absolute accuracy for large populations, so researchers must estimate

it based on samples. Researchers use information from the sample, called a 'statistic', to estimate population parameters.

4. Sampling Error

Sampling error is not necessarily the result of mistakes made in the sampling procedure. Instead, variations occur due to the chance selection of different individuals.

3.10 TYPES OF SAMPLING DESIGNS

Sampling designs are of two types. The first is called probability-sampling design, and the second is non-probability sampling design. In this unit, we discuss each type of sampling design in terms of its essential character and procedure.

i) **Probability Sampling Design:** Probability sampling provides a statistical basis for stating that a sample is representative of the 'target population'. In a probability sample, every element in the population has a known chance of being included in the sample. This allows for estimates of the accuracy of sample findings in approximating what we would find out if we had conducted a census of the total population.

ii) Non-probability Sampling Design: In non-probability sampling designs, we do not know whether an element of the population has an equal chance of being selected. Its probability of selection cannot be determined, as with probability sampling, where each element has a 50 per cent chance of being selected and a 50 per cent chance of not being included in the sample. The non-probability samples are drawn based on judgment regarding the characteristics of the target population and the needs of a survey. With non-probability sampling, some members of the eligible target population have a chance of being chosen, and others do not. Thus, the statistical precision estimates cannot be made with this sample. The non-probability sampling designs are preferred when there is no possibility of probability sampling. Whenever feasible, probability-sampling designs are preferred.

3.11 PROBABILITY SAMPLING PROCEDURES

The following are various probability sampling procedures:

i) Simple Random Sampling

In simple random sampling, each member of the population under study has an equal chance of being selected. The method involves selecting at random from a list of the population (a sampling frame). For example, suppose we need to select 300 people from the Universe (village) study to assess their access to common property resources. In that case, we can write each person's name on a separate slip and then put the slip in a container, and we can conduct a lottery to select 300 people to

conduct a study. In the case of an infinite population, the selection of each item in a random sample is controlled by the same probability, and successive selections are independent of each other. In this process, there is an equal chance for everyone to get selected. One essential requisite for this kind of sampling is that a complete list of the population (sampling frame) is needed.

a. There is a chance to get an unbiased sample without much technical difficulty.
b. It is unbiased
c. Selection will be based on a lottery or through a table of random numbers, or now through computer-generated random numbers. The lottery method is adopted for smaller populations or sampling frames. For more oversized sampling frames, the computer-generated numbers are selected.
d. It is not a statistically efficient method.
e. It does not provide fair representation to the sub-group population

ii) Systematic Sampling

It is another method of simple random sampling. In this method, the selection is made from the list. The researcher takes the first unit randomly. After that, he/she chooses from samples from fixed intervals. For example, If the researcher can choose every 15^{th} house on one side of the street or every 10^{th} name from the list, it is called systematic sampling. In this technique, once the first sample unit is identified randomly, the remaining unit is chosen easily.

iii) Stratified Sampling

It is also called proportional random sampling. It is more efficient statistically because it is an improved version of simple and systematic random sampling. In this sampling method, the population is divided into specified strata. In this Stratified Sampling, the population is grouped into homogenous groups (sub-groups or strata) such as age, gender, class, and location. In stratified sampling, the researcher controls the relative size of each stratum rather than letting random processes control it. This guarantees the representation of different strata within a sample. However, one condition is that the stratified sampling procedures produce samples more representative of the population than simple random or systematic samples if the stratum information is accurate.

iv) Cluster Sampling

The most widely employed probability sample design in survey research is cluster sampling. It addresses two problems: the lack of a reasonable sampling frame and the costs of reaching a sampled element or a case. For example, there is no single list of undergraduates in colleges in a city. Even if one gets an accurate sampling frame, it would cost too much to reach many undergraduates as the colleges are spread out geographically in the city. Researchers use a sampling design that involves 'clusters' instead

of a single sampling frame in this case. In this case, the cluster will be the college.

A cluster is a naturally occurring unit (e.g., a school with many classrooms, students, and teachers; a city with zones (East, West, South, Central, North); states. The clusters are selected randomly, and all members of the selected clusters are included in the sample, or simply random, systematic, or stratified samples are taken from each cluster. Cluster sampling is used in extensive surveys. It differs from stratified sampling in that with cluster sampling, one starts with a naturally occurring constituency. The researcher selects from among the clusters and either surveys all members of the selection or randomly selects from among them. The resulting sample may not represent areas not covered by the cluster, nor does one cluster necessarily represent another.

v) Stage Sampling

Stage sampling also known as multi-stage sampling is an extension of cluster sampling. It involves the selection of a sample in several stages. That is, taking samples from samples. Suppose we want to survey children's academic performance in schools in a large city. One type of stage sampling might be to select several schools randomly, and from each of these schools, select several classes and select children from within these classes. Another type of stage sampling could be to select one school in terms of either the geographic region of the school in the community/city or in terms of the type of school (public, private aided, private unaided, etc.) and take their simple random sampling, systematic sampling, or stratified sampling or even mixture of all these.

3.12 NON-PROBABILITY SAMPLING PROCEDURES

The following are the non-probability sampling procedures:

i) **Accidental or Convenience Sampling**

This is also called the 'man-on-the-street' survey. It involves choosing the individuals/cases readily available on the street, marketplace, school, or cinema theatre until the required sample size is obtained. This survey can produce ineffective, highly unrepresentative samples and is not recommended. When a researcher haphazardly selects a convenient sample, he can quickly get a sample that misrepresents the population. Such samples are cheap and quick, although biases and errors are plenty. An example of this kind of survey is the kind of interviews, television programmes conduct on the street.

ii) **Quota Sampling**

Quota sampling has often been described as the non-probability equivalent of stratified sampling. In quota sampling, the researcher divides the population into sub-groups or categories such as men and women, reserved castes

and non-reserved castes, arts and commerce, younger and older, and then decides the proportion of individuals in each category or sub-group. Thus, the number of respondents is fixed in various sample categories.

iii) Purposive or Judgmental Sampling

In purposive sampling, researchers handpick the cases to be included in the sample based on their judgment of their typicality. That means the researcher's judgment is used in selected cases with a specific purpose. Purposive sampling is appropriate in the following three situations. First, a researcher uses it to select unique cases that are exceptionally informative. Second, a researcher may use purposive sampling to select members of a difficult-to-reach, specialized population. Third, purposive sampling is preferred when a researcher wants to identify particular types of cases for in-depth investigation.

iv) Dimensional Sampling

This is a further refinement of quota sampling. It involves identifying various factors of interest in a population and obtaining at least one respondent of every combination of those factors.

v) Snowball Sampling

It is also called a network or chain referral or reputational sampling, and it is a method for identifying and sampling (or selecting) the cases in a network. Snowball sampling is based on an analogy to a snowball which begins small but becomes more extensive as it rolls on wet snow and picks up additional snow. Friendship networks are the most important sources of this kind of sampling. Further, professional associations and chat groups may also provide bases for such sampling.

Sample Size

A question often asked is about the size of the sample. How large should it be? The best answer could be that it depends. That means there is no clearcut answer to this question. However, the survey sampling literature does give prospective survey researchers general advice. For some people, a sample of thirty is the bare minimum if the researcher plans to undertake some form of statistical analysis of the data. However, the sample size depends on the researcher's plans, how accurate the sample has to be for his purposes, and population characteristics. It may be stated here that a large sample alone does not guarantee a representative sample. Further, when we increase the sample size, we increase costs. Larger samples mean increased costs. A researcher may keep in mind all these considerations while judging the size of the sample.

CHECK YOUR PROGRESS 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the unit.

1. Write a short note on the principles of research design.

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2. Write a short note on sampling techniques.

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3. Write a short note on types of research design.

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3.13 LET US SUM UP

The Unit introduced the learners to the significance of developing research design. In this unit, we have discussed the need for research design and principles and various types of research design. We have also discussed the need for sampling, sampling techniques and different types of sampling procedures.

3.14 KEY WORDS

Completely Randomized Design (CRD) : CRD involves only two principles namely the principle of replication and the principle of randomization of experimental designs. The essential characteristic of the design is that subjects are randomly assigned to experimental treatments or vice-versa.

Research Design : The research design is the arrangement of conditions for data collection and analysis in a manner that aims to combine relevance to the research purpose with the economy in procedure.

3.15 SUGGESTED FURTHER READING/ REFERENCES

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3.16 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1. Please refer to section 3.4

2. Please refer to section 3.7

3. Please refer to section 3.5