

## 5.6 SCALING

In research we quite often face measurement problem (since we want a valid measurement but may not obtain it), specially when the concepts to be measured are complex and abstract and we do not possess the standardised measurement tools. Alternatively, we can say that while measuring attitudes and opinions, we face the problem of their valid measurement. Similar problem may be faced by a researcher, of course in a lesser degree, while measuring physical or institutional concepts. As such we should study some procedures which may enable us to measure abstract concepts more accurately. This brings us to the study of scaling techniques.

Scaling describes the procedures of assigning numbers to various degrees of opinion, attitude and other concepts. This can be done in two ways viz., (i) making a judgement about some characteristic of an individual and then placing him directly on a scale that has been defined in terms of that characteristic and (ii) constructing questionnaires in such a way that the score of individual's responses assigns him a place on a scale. It may be stated here that a scale is a continuum, consisting of the highest point (in terms of some characteristic e.g., preference, favourableness, etc.) and the lowest point along with several intermediate points between these two extreme points. These scale-point positions are so related to each other that when the first point happens to be the highest point, the second point indicates a higher degree in terms of a given characteristic as compared to the third point and the third point indicates a higher degree as compared to the fourth and so on. Numbers for measuring the distinctions of degree in the attitudes/opinions are, thus, assigned to individuals

## 5.8 SCALING TECHNIQUES

Scaling techniques are broadly classified into 'comparative scaling techniques' and 'non-comparative scaling techniques'. Comparative scales involve direct comparison of stimulus objects. Comparative scale data are interpreted in relative terms and are measured on ordinal scale. This technique is a non-numeric scaling technique as ordinal data cannot be used for numeric operations. These techniques are easy to understand and apply. They force the respondent to choose between the stimulus objects. For example, respondents are asked whether they like to use toothpaste of brand 'A' or brand 'B'. The respondents have to choose one out of 'A' or 'B' even if there is very small difference in their liking of the two brands. The main disadvantage of comparative scales is the inability to generalize beyond the stimulus objects. For example, if we want to compare a third brand of toothpaste 'C' with the previous ones, we have to conduct a new study.

In non-comparative scales, each object is scaled independently of the others. For example, the respondents are asked to give preference score on a 1 to 6 scale to brand 'A' of the toothpaste. Here 1 = not preferred at all and 6 = highly preferred. Similar scores can be obtained for brand 'B' and 'C'. Because of the numeric data and wide applications, non-comparative scales are widely used in research.

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Now we present some comparative and non-comparative scales which are commonly used.

### 5.8.1 Comparative Scaling Techniques

Common comparative scaling techniques are

- (i) Paired comparison
- (ii) Rank order
- (iii) Constant sum

A brief discussion on each of the above techniques is given below:

#### (i) Paired Comparison

In this method the respondent can express his attitude by making a choice between two objects, say between a new flavour of soft drink and an established brand of drink. But when there are more than two stimuli to judge, the number of judgements required in a paired comparison is given by the formula:

$$N = \frac{n(n-1)}{2}$$

where  $N$  = number of judgements

$n$  = number of stimuli or objects to be judged.

For instance, if there are ten suggestions for bargaining proposals available to a worker's union, there are 45 paired comparisons that can be made with them. When  $N$  happens to be a big figure, there is the risk of respondents giving ill considered answers or they may even refuse to answer. We can reduce the number of comparisons per respondent either by presenting to each one of them only a sample of stimuli or by choosing a few objects which cover the range of attractiveness at about equal intervals and then comparing all other stimuli to these few standard objects. Thus, paired-comparison data may be treated in several ways. If there is substantial consistency, we will find that if  $X$  is preferred to  $Y$ , and  $Y$  to  $Z$ , then  $X$  will consistently be preferred to  $Z$ . If this is true, we may take the total number of preferences among the comparisons as the score for that stimulus.

It should be remembered that paired comparison provides ordinal data, but the same may be converted into an interval scale by the method of the *Law of Comparative Judgement* developed by L.L. Thurstone. This technique involves the conversion of frequencies of preferences into a table of proportions which are then transformed into  $Z$  matrix by referring to the table of area under the normal curve. J.P. Guilford in his book "Psychometric Methods" has given a procedure which is relatively easier. The method is known as the *Composite Standard Method* and can be illustrated as under:

Suppose there are four proposals which some union bargaining committee is considering. The committee wants to know how the union membership ranks these proposals. For this purpose a sample of 100 members might express the views as shown in the following table:

## **(ii) Rank Order**

Under this method of comparative scaling, the respondents are asked to rank their choices. This method is easier and faster than the method of paired comparisons stated above. For example, with 10 items it takes 45 pair comparisons to complete the task, whereas the method of rank order simply requires ranking of 10 items only. The problem of transitivity (such as *A* prefers to *B*, *B* to *C*, but *C* prefers to *A*) is also not there in case we adopt method of rank order. Moreover, a complete ranking at times is not needed in which case the respondents may be asked to rank only their first, say, four choices while the number of overall items involved may be more than four, say, it may be 15 or 20 or more. To secure a simple ranking of all items involved we simply total rank values received by each item. There are methods through which we can as well develop an interval scale of these data. But then there are limitations of this method. The first one is that data obtained through this method is ordinal data and hence rank ordering is an ordinal scale with all its limitations. Then there may be the problem of respondents becoming careless in assigning ranks particularly when there are many (usually more than 10) items.

## **(iii) Constant Sum**

Constant sum scaling technique is used to assess the relative importance attached by a respondent to the stimulus objects. The respondent gives certain points to each stimulus object out of a fixed sum of points. This fixed sum is usually taken as 100, but it could be some other value also. For example, a family planing a holiday, fixes the budget of Rs. 50,000. They wish to plan the expenditures on transportation, accommodation, food, drinks, and others. The constant sum is 50,000 in this example which could be divided as

Transportation	10,000
Accommodation	20,000
Food	12,000
Drink	0
Others	8,000



The data obtained here is numeric but cannot be generalized beyond the list of stimulus objects. So, this data is considered as ordinal data. This technique distinguishes the objects in less time. However, it is not useful with uneducated people or with large number of objects.

## 5.8.2 Non-comparative Scaling Techniques

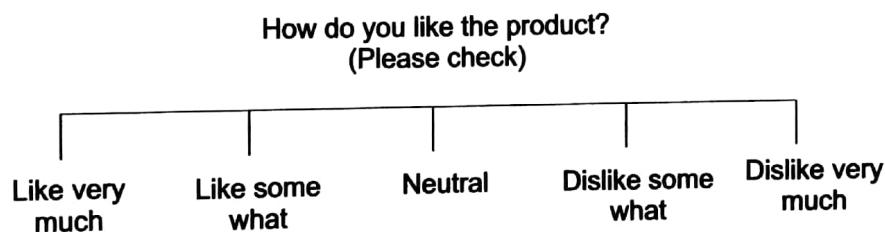
Most common non-comparative scaling techniques are

- (i) Continuous rating or graphic rating
- (ii) Itemized rating
- (iii) Simple/multiple category scale
- (iv) Verbal frequency scale

These techniques are discussed in brief as follows:

### (i) Continuous Rating or Graphic Rating

The *graphic rating scale* is quite simple and is commonly used in practice. Under it the various points are usually put along the line to form a continuum and the rater indicates his rating by simply making a mark (such as  $\checkmark$ ) at the appropriate point on a line that runs from one extreme to the other. Scale-points with brief descriptions may be indicated along the line, their function being to assist the rater in performing his job. The following is an example of five-points graphic rating scale when we wish to ascertain people's liking or disliking any product:



**Fig. 5.2**

This type of scale has several limitations. The respondents may check at almost any position along the line which is fact may increase the difficulty of analysis. The meanings of the terms like "very much" and "some what" may depend upon respondent's frame of reference so much so that the statement might be challenged in terms of its equivalency. Several other rating scale variants (e.g., boxes replacing line) may also be used.

### (ii) Itemized Rating

A scale having numbers or brief descriptions of each category is provided. Categories are ordered in terms of scale positions. The respondents select one of the categories that best describes the stimulus object. Commonly used itemized rating scales are

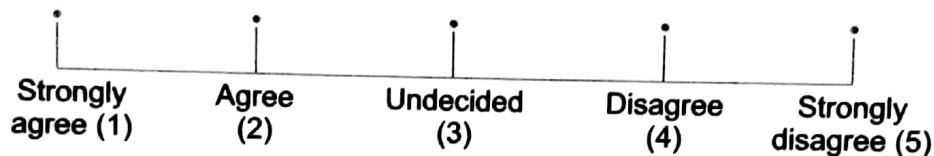
#### (A) Likert Scales

Likert scales or summated scales are developed by utilizing the item analysis approach wherein a particular item is evaluated on the basis of how well it discriminates between those persons whose total score is high and those whose score is low. Those items or statements that best meet this sort of discrimination test are included in the final instrument.

Thus, summated scales consist of a number of statements which express either a favourable or unfavourable attitude towards the given object to which the respondent is asked to react. The respondent indicates his agreement or disagreement with each statement in the instrument. Each response is given a numerical score, indicating its favourableness or unfavourableness, and the scores are totalled to measure the respondent's attitude. In other words, the overall score represents the respondent's position on the continuum of favourable-unfavourableness towards an issue.

Most frequently used summated scales in the study of social attitudes follow the pattern devised by Likert. For this reason they are often referred to as Likert-type scales. In a Likert scale, the respondent is asked to respond to each of the statements in terms of several degrees, usually five degrees (but at times 3 or 7 may also be used) of agreement or disagreement. For example, when asked to express opinion whether one considers his job quite pleasant, the respondent may respond in any one of the following ways: (i) strongly agree, (ii) agree, (iii) undecided, (iv) disagree, (v) strongly disagree.

We find that these five points constitute the scale. At one extreme of the scale there is strong agreement with the given statement and at the other, strong disagreement, and between them lie intermediate points. We may illustrate this as under:



**Fig. 5.3**

Each point on the scale carries a score. Response indicating the least favourable degree of job satisfaction is given the least score (say 1) and the most favourable is given the highest score (say 5). These score—values are normally not printed on the instrument but are shown here just to indicate the scoring pattern. The Likert scaling technique, thus, assigns a scale value to each of the five responses. The same thing is done in respect of each and every statement in the instrument. This way the instrument yields a total score for each respondent, which would then measure the respondent's favourableness toward the given point of view. If the instrument consists of, say 30 statements, the following score values would be revealing.

$30 \times 5 = 150$  Most favourable response possible

$30 \times 3 = 90$  A neutral attitude

$30 \times 1 = 30$  Most unfavourable attitude.

The scores for any individual would fall between 30 and 150. If the score happens to be above 90, it shows favourable opinion to the given point of view, a score of below 90 would mean unfavourable opinion and a score of exactly 90 would be suggestive of a neutral attitude.

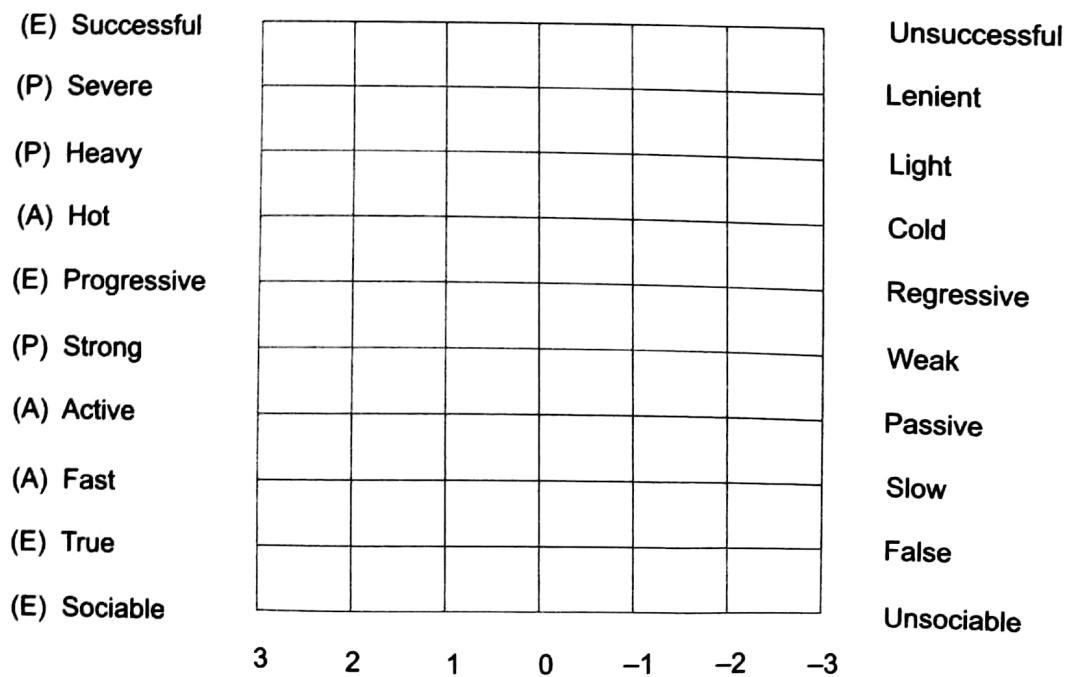
**Procedure:** The procedure for developing a Likert-type scale is as follows:

- (i) As a first step, the researcher collects a large number of statements which are relevant to the attitude being studied and each of the statements expresses definite favourableness or unfavourableness to a particular point of view or the attitude and that the number of favourable and unfavourable statements is approximately equal.

- i) After the statements have been gathered, a trial test should be administered to a number of subjects. In other words, a small group of people, from those who are going to be studied finally, are asked to indicate their response to each statement by checking one of the categories of agreement or disagreement using a five point scale as stated above.
- ii) The response to various statements are scored in such a way that a response indicative of the most favourable attitude is given the highest score of 5 and that with the most unfavourable attitude is given the lowest score, say, of 1.
- v) Then the total score of each respondent is obtained by adding his scores that he received for separate statements.
- v) The next step is to array these total scores and find out those statements which have a high discriminatory power. For this purpose, the researcher may select some part of the highest and the lowest total scores, say the top 25 per cent and the bottom 25 per cent. These two extreme groups are interpreted to represent the most favourable and the least favourable attitudes and are used as criterion groups by which to evaluate individual statements. This way we determine which statements consistently correlate with low favourability and which with high favourability.
- (vi) Only those statements that correlate with the total test should be retained in the final instrument and all others must be discarded from it.

### (B) Semantic Differential Scale

Semantic differential scale or the S.D. scale developed by Charles E. Osgood, G.J. Suci and P.H. Tannenbaum (1957), is an attempt to measure the psychological meanings of an object to an individual. This scale is based on the presumption that an object can have different dimensions of connotative meanings which can be located in multidimensional property space, or what can be called the semantic space in the context of S.D. scale. This scaling consists of a set of bipolar rating scales, usually of 7 points, by which one or more respondents rate one or more concepts on each scale item. For instance, the S.D. scale items for analysing candidates for leadership position may be shown as under:



**Fig. 5.4**

\* John W. Best and James V. Kahn, *Research in Education*, 5th ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 1986, p. 183.

Candidates for leadership position (along with the concept—the 'ideal' candidate) may be compared and we may score them from +3 to -3 on the basis of the above stated scales. (The letters, *E, P, A* showing the relevant factor viz., evaluation, potency and activity respectively, written along the left side are not written in actual scale. Similarly the numeric values shown are also not written in actual scale.)

Osgood and others did produce a list of some adjective pairs for attitude research purposes and concluded that semantic space is multidimensional rather than unidimensional. They made sincere efforts and ultimately found that three factors, viz., evaluation, potency and activity, contributed most to meaningful judgements by respondents. The evaluation dimension generally accounts for 1/2 and 3/4 of the extractable variance and the other two factors account for the balance.

8. *Figure: Various steps involved in developing S.D. scale are as follows:*

### **(C) Stapel Scale**

This scale was developed by John Stapel. This is a unipolar rating scale with usually 10 categories numbered from  $-5$  to  $+5$ . This scale does not have zero or the neutral point. Respondents rate how each term describes the object by selecting the appropriate number. Positive number means the term describes the object accurately, while negative number implies that the term describes the object inaccurately.  $+5$  means the highest degree of accuracy while  $-5$  means the highest degree of inaccuracy.

For example, consider the phrases (i) Tasty food, (ii) Fast Service, and (iii) Good ambience for a restaurant. A respondent is asked to rate how accurately these terms or phrases describe a specified restaurant.

+5	+5	+5
+4	+4	+4
+3	+3	<b>+3</b>
+2	+2	+2
<b>+1</b>	+1	+1
Tasty Food	Fast Service	Good Ambience
-1	-1	-1
-2	<b>-2</b>	-2
-3	-3	-3
-4	-4	-4
-5	-5	-5

The respondent selects +1 for 'tasty food,' - 2 for 'fast service' and +3 for 'good ambience'. This means the respondent thinks that the phrase 'tasty food' is accurate with a minimum degree of accuracy, phrase 'fast service' is somewhat inaccurate, while 'good ambience' is sufficiently accurate. So according to the respondent the ambience of the restaurant is good, food taste is okay but service is slow.

This method is applicable when the responses are rated on a single dimension. The method is very economic and data can be collected over telephonic interview also. Some researchers think that the method is confusing and of not much use.

### (iii) Single/Multiple Category Scales

These scales are also known as dichotomous scales. Here we have two or more mutually exclusive responses. For example, - 'Yes' and 'No', 'True' and 'False'. The respondent has to choose only one out of the given categories. It would be clear from the following example questions of a questionnaire:

1. Do you play cricket ?
  - Yes
  - No
2. What is your marital status?
  - Unmarried
  - Married
  - Divorce
  - Widower
3. What is your employment type?
  - Salaried
  - Self employed business
  - Self employed professional
  - Student
  - Retired
  - Home maker



These scales can also be generalized to have more than one responses. For example,

1. What do you own?

Car	<input type="checkbox"/>	House	<input type="checkbox"/>
Computer	<input type="checkbox"/>	Home theatre system	<input type="checkbox"/>

2. What are you interested in?

Music	<input type="checkbox"/>	Films	<input type="checkbox"/>
Sports	<input type="checkbox"/>	Reading	<input type="checkbox"/>
Travelling	<input type="checkbox"/>		

3. What do you like to do on internet?

Social networking	<input type="checkbox"/>	E-mail	<input type="checkbox"/>
News reading	<input type="checkbox"/>	Knowledge gaining	<input type="checkbox"/>
Gaming	<input type="checkbox"/>		

It should be ensured that the provided choice exhaust almost all possible answers of the asked question. The choice 'others' may be given along with other choices. The collected data is on nominal scale. The method is easy and very popular on internet surveys.

#### (iv) Verbal Frequency Scale

This scale is used when the respondent is unable or unwilling to give the exact numbers in the answer.

For example,

How often do you eatout?

1. Frequently                      2. Sometimes                      3. Rarely                      4. Never

This scale provides only an approximation of frequency and so the data is on ordinal scale.

**Dimensions:** In unidimensional scale, only one attribute of the object is measured. While, a multidimensional scale considers that an object is described with several dimensions. For example, the popularity of a restaurant can be measured by a single measure food taste. It can be defined on multiple dimensions like food taste, service, cleanliness, ambience, etc.

**Number of scale categories:** Larger number of scale categories will provide better precision in the collected data. However, it would become inconvenient for the respondent. So, the number of scale categories is a trade-off between precision and convenience. It should be chosen with care.

**Balanced and unbalanced scales:** In balanced scale, number of favorable and unfavorable categories are equal, while they are unequal in an unbalanced scale. The scale should be balanced in general to collect an unbiased opinion. However, if the distribution of responses is likely to be skewed on one direction, an unbalanced scale having more categories on the opposite direction is used.

## 5.2 CLASSIFICATIONS OF MEASUREMENT SCALES

From what has been stated above, we can write that scales of measurement can be considered in terms of their mathematical properties. The most widely used classification of measurement scales are: (a) nominal scale; (b) ordinal scale; (c) interval scale; and (d) ratio scale.

*Just meaning*

- ) **Nominal scale:** Nominal scale is simply a system of assigning number symbols to events in order to label them. The usual example of this is the assignment of numbers of basketball players in order to identify them. Such numbers cannot be considered to be associated with an ordered scale for their order is of no consequence; the numbers are just convenient labels for the particular class of events and as such have no quantitative value. Nominal scales provide convenient ways of keeping track of people, objects and events. One cannot do much with the numbers involved. For example, one cannot usefully average the numbers on the back of a group of football players and come up with a meaningful value. Neither can one usefully compare the numbers assigned to one group with the numbers assigned to another. The counting of members in each group is the only possible arithmetic operation when a nominal scale is employed. Accordingly, we are restricted to use mode as the measure of central tendency. There is no generally used measure of dispersion for nominal scales. Chi-square test is the most common test of statistical significance that can be utilized, and for the measures of correlation, the contingency coefficient can be worked out.

Nominal scale is the least powerful level of measurement. It indicates no order or distance relationship and has no arithmetic origin. A nominal scale simply describes differences between things by assigning them to categories. Nominal data is, thus, counted data. The scale wastes any information that we may have about varying degrees of attitude, skills, understandings, etc. In spite of all this, nominal scales are still very useful and are widely used in surveys and other *ex-post-facto* research when data is being classified by major sub-groups of the population.

- (b) **Ordinal scale:** The lowest level of the ordered scale that is commonly used is the ordinal scale. The ordinal scale places events in order, but there is no attempt to make the intervals of the scale equal in terms of some rule. Rank orders represent ordinal scales and are frequently used in research relating to qualitative phenomena. A student's rank in his graduation class involves the use of an ordinal scale. One has to be very careful in making statement about scores based on ordinal scales. For instance, if Ram's position in his class is 10 and Mohan's position is 40, it cannot be said that Ram's position is four times as good as that of Mohan. The statement would make no sense at all. Ordinal scales only permit the ranking of items from highest to lowest. Ordinal measures have no absolute values, and the real differences between adjacent ranks may not be equal. All that can be said is that one person is higher or lower on the scale than another, but more precise comparisons cannot be made.

Thus, the use of an ordinal scale implies a statement of 'greater than' or 'less than' (an equality statement is also acceptable) without our being able to state how much greater or less. The real difference between ranks 1 and 2 may be more or less than the difference between ranks 5 and 6. Since the numbers of this scale have only a rank meaning, the appropriate measure of central tendency is the median. A percentile or quartile measure is used for measuring dispersion. Correlations are restricted to various rank order methods. Measures of statistical significance are restricted to the non-parametric methods.

- (c) **Interval scale:** In the case of interval scale, the intervals are adjusted in terms of some rule that have been established as a basis for making the units equal. The units are equal only in so far as one accepts the assumptions on which the rule is based. Interval scales

can have an arbitrary zero, but it is not possible to determine for them what may be called an absolute zero or the unique origin. The primary limitation of the interval scale is the lack of a true zero; it does not have the capacity to measure the complete absence of a trait or characteristic. The Fahrenheit scale is an example of an interval scale and shows similarities in what one can and cannot do with it. One can say that an increase in temperature from  $30^{\circ}$  to  $40^{\circ}$  involves the same increase in temperature as an increase from  $60^{\circ}$  to  $70^{\circ}$ , but one cannot say that the temperature of  $60^{\circ}$  is twice as warm as the temperature of  $30^{\circ}$  because both numbers are dependent on the fact that the zero on the scale is set arbitrarily at the temperature of the freezing point of water. The ratio of the two temperatures,  $30^{\circ}$  and  $60^{\circ}$ , means nothing because zero is an arbitrary point.

Interval scales provide more powerful measurement than ordinal scales for interval scale also incorporates the concept of equality of interval. As such more powerful statistical measures can be used with interval scales. Mean is the appropriate measure of central tendency, while standard deviation is the most widely used measure of dispersion. Product moment correlation techniques are appropriate and the generally used tests for statistical significance are the 't' test and 'F' test.

- (d) **Ratio scale:** Ratio scales have an absolute or true zero of measurement. The term 'absolute zero' is not as precise as it was once believed to be. We can conceive of an absolute zero of length and similarly we can conceive of an absolute zero of time. For example, the zero point on a centimeter scale indicates the complete absence of length or height. But an absolute zero of temperature is theoretically unobtainable and it remains a concept existing only in the scientist's mind. The number of minor traffic-rule violations and the number of incorrect letters in a page of type script represent scores on ratio scales. Both these scales have absolute zeros and as such all minor traffic violations and all typing errors can be assumed to be equal in significance. With ratio scales involved one can make statements like "Jyoti's" typing performance was twice as good as that of "Reetu." The ratio involved does have significance and facilitates a kind of comparison which is not possible in case of an interval scale.

Ratio scale represents the actual amount of variables. Measures of physical dimensions such as weight, height, distance, etc. are examples. Generally, all statistical techniques are usable with ratio scales and all manipulations that one can carry out with real numbers can also be carried out with ratio scale values. Multiplication and division can be used with this scale but not with other scales mentioned above. Geometric and harmonic means can be used as measures of central tendency and coefficients of variation may also be calculated. Thus, proceeding from the nominal scale (the least precise type of scale) to ratio scale (the most precise), relevant information is obtained increasingly. If the nature of the variables permits, the researcher should use the scale that provides the most precise description. Researchers in physical sciences have the advantage to describe variables in ratio scale form but the behavioural sciences are generally limited to describe variables in interval scale form, a less precise type of measurement.

of variables. Factor analysis is used for this purpose.

## Types of Statistical Analysis

Statistical analysis is used for estimating the values of unknown characteristics (parameters) of the population and for testing hypothesis for drawing inferences. Analysis may therefore be broadly classified into (1) descriptive analysis and (2) inferential analysis.

### Descriptive Analysis

This type of analysis describes the nature of an object or phenomenon under study. This analysis provides us with profiles of organisations, work groups, persons and other subjects on any of a multitude of characteristics such as size, compositions, efficiency, preferences etc.

This sort of analysis may describe data on one variable, two variables or more than two variables. Accordingly it is called *univariate analysis*, *bivariate analysis* and *multivariate analysis* respectively.

Multivariate analysis consists of (a) multiple regression analysis, (b) multiple discriminant analysis, (c) canonical analysis, (d) multivariate analysis of variance and (e) factor analysis.

- (a) **Multiple Regression Analysis** is made when one dependent variable is presumed to be a function of two or more independent variables.
- (b) **Multiple Discriminant Analysis** is appropriate when the dependent variable cannot be measured but can be identified with a particular group on the basis of several predictor variables.
- (c) **Canonical Analysis** is used for simultaneously predicting a set of dependent variables from their joint covariance with a set of independent variables.
- (d) **In Multivariate Analysis of Variance**, the ratio of 'among group variance' to 'within group variance' is worked on a set of variables. This is useful for testing hypothesis concerning multivariate differences among group responses to experimental manipulations.
- (e) **Factor Analysis** is useful for grouping a large number of variables into a few independent factor dimensions.

### Inferential Analysis

Inferential analysis is concerned with drawing inferences and conclusions from the findings of a research study. There are two areas of statistical inference, viz., (a) statistical estimation and (b) the testing of hypothesis.

- (a) **Statistical estimation** involves estimation of the population parameters from the results of sample data analysis. In order to arrive at accurate estimates of parameters, the researcher has to effectively deal with three problems: (i) the precise definition of population, (ii) the determination of adequate sample size, and (iii) the selection of a representative sample.
- (b) **Testing Hypothesis:** Hypotheses are tested with tests of significance. This testing involves the assessment of the probability of specific sampling results under assumed population conditions. Assumptions about the population parameters are made in advance and the sample then provides the test of these assumptions. An inference is also drawn about the relationships among variables.

Inferential analysis enables us to make *decisions* and draw *conclusions* from studies which could otherwise not be feasible because of the size of the universe or of prohibitive costs of a census survey or of destructive testing procedures as in quality control.

Inferential analysis involves an estimate of the accuracy of the inference called *reliability*. The reliability is expressed in terms of probability determined from the relevant statistical distribution *i.e.*, confidence levels.



# MEASURES OF RELATIONSHIP

A significant part of decisions taken by managers and researchers are based on the prediction of future trends which are made on the basis of relationship between what is already known and what is to be estimated. The measures which are used to determine the relationship between variables are known as measures of relationship. The two most commonly used measures are correlation and regression. Correlation identifies the degree of relationship between two variables and regression is used to study the nature of relationship and develop a cause and effect relationship.

## I. Co-rrrelation Analysis

Correlation is concerned with identifying the association between two or more variables.

It can be classified as :

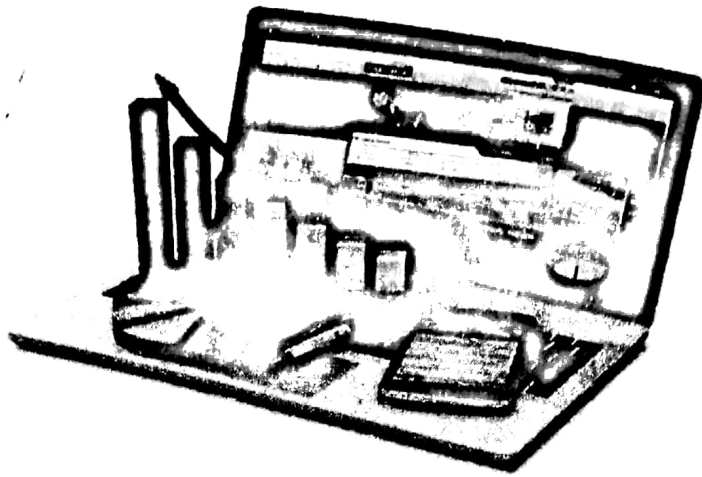
(a) **Positive and Negative Correlation.** If both the variables move in same direction *i.e.* increase in one variable leads to increase in other variable and vice versa then they are said to be positively correlated. When the variables move in opposite direction *i.e.* increase in one variable and vice versa leads to decrease in other variable then it is termed as negative correlation.

(b) **Simple, Partial and Multiple Correlation.** When only two variables are to be studied it is termed as simple correlation. When the relationship is studied for more than two variables then it is termed as multiple correlation. In partial correlation, the effect of only two variables is studied simultaneously at a point and others are kept constant *i.e.* more than two variables are recognised but the relationship of only two is studied at a point of time simultaneously.

(c) **Linear and Non-linear Correlation.** When the amount of change in one variable bears a constant ratio to amount of change in other variable then it is linear correlation. However if the amount of change in one variable does not bear a constant relationship with other variable then it is a non-linear correlation.

Correlation can be studied using various methods like scatter diagram method, Karl Pearson's co-efficient of correlation, Spearman's rank correlation, concurrent deviation method and least squares method (which





# CHI-SQUARE TEST

## INTRODUCTION

In our discussion on hypothesis testing in the previous chapters, it was seen that hypothesis tests can be parametric tests or non parametric tests. The former tests are based on certain assumptions regarding the population or distribution e.g. we assume that the samples have been drawn from normally distributed population. The most common of these tests t, F and Z tests have been discussed in detail. The other category of tests namely non-parametric tests are an answer to the rigidly defined assumptions of parametric tests. These alternative set of tests make no assumption about the parameters of population or about the population from which we draw our samples. The fact that these tests are distribution free and can be used with any type of population make them a popular choice with the researchers. The chi-square test can be used as a parametric as well as nonparametric test for comparing the variance of the population; as a test of independence or as a test of goodness of fit.

## $\chi^2$ DISTRIBUTION

The chi square test is represented by the symbol  $\chi^2$  and owes its origin to greek letter 'chi'. This test was first used by Karl Pearson and is one of the most widely used test today.

Through the  $\chi^2$  test we are able to determine the extent of difference between the theory or expected value and the observed or the actual value. Mathematically it is defined as follows :

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where, O = Observed frequencies

E = Expected frequencies.

$\chi^2$  test helps us to determine the extent of difference between the theory or expected value and the observed or the actual value.

# $\chi^2$ AS A NON-PARAMETRIC TEST

As stated earlier  $\chi^2$  is one of the most popular non-parametric test. The  $\chi^2$  is especially useful where nominal data is used, although it can be used for higher scales also. The applicability of  $\chi^2$  can be summed up as follows.

## I. $\chi^2$ As a test of independence

$\chi^2$  as a test of independence can establish if two or more attributes are associated or independent.

Using  $\chi^2$  as a test of independence, we can establish if two or more attributes are associated or independent *e.g.* a doctor may be interested in knowing if the new BCG vaccine is effective in controlling the target diseases or not. A sociologist may be interested in knowing if there is any relationship between divorce rates and working wives. To test for all these examples, we start with the null hypothesis that there is no association between the attributes specified *i.e.* the attributes are independent. The decision is taken on the basis of following criteria :

**Acceptance criteria :** If for a specified significance level the calculated value of  $\chi^2$  is less than the table value of  $\chi^2$  item, null hypothesis holds good and it can be said that the attributes are independent.

**Rejection criteria :** However, if for a specified significance level the calculated value of  $\chi^2$  is greater than the table value of  $\chi^2$ , it calls for rejecting the null hypothesis thereby conveying that the attributes are related.

## II. $\chi^2$ as a test of goodness of fit

$\chi^2$  as a test of goodness of fit is used to determine how well a theoretical distribution fits on the observed data.

As the name suggests,  $\chi^2$  can be used to determine how well a theoretical distribution (*e.g.*, poisson or normal) fits on the observed data or how appropriately a theoretical distribution fits empirical distribution. Although, when we fit a theoretical curve to an empirical data, on inspection one can tell how well the distribution is in accordance to the observed data. However using  $\chi^2$  gives us a precise value of the fit. The null hypothesis is based on the assumption that there is a concordance between the theoretical distribution and observed data. The criteria of acceptance and rejection are the same as for test of independence. An acceptance of null hypothesis states that the fit is good and a rejection conveys that the fit is poor. However, a word of caution is given by Chou<sup>2</sup>, "It should be borne in mind that in repeated sampling, too good a fit is just as likely as too bad a fit. When the computed chi square value is too close to zero we should suspect the possibility that two sets of frequencies have been manipulated in order to force them to agree and therefore the design of our experiment should be thoroughly checked."

## III. As a test of homogeneity

$\chi^2$  as a test homogeneity is used to find out if two or more randomly selected independent samples have been drawn from the same population or not.

A corollary of test of independence, there is a test of homogeneity. This test is used to find out if two or more randomly selected independent samples have been drawn from the same population or not. This test is different from test of independence on two counts : Firstly test of independence tries to find

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out if one attribute is independent of another whereas test of homogeneity tries to find out if the random samples have been drawn from the same population. Secondly, test of independence uses a single sample whereas the latter uses two or more samples.

## UNIT - I INTRODUCTION

Research can be defined as an organized and systematic study of materials and sources in order to discover new things and establish facts and reach new conclusions.

The word research is composed of two syllables 're' and search. The dictionary meaning of the two together means describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles.

Lina O'Leary has defined research as a "creative and strategic thinking process that involves constantly assessing, reassessing and making decisions about the best possible means for obtaining trustworthy information, carrying out appropriate analysis and tracing credible solutions."

Thus research involves :-

- 1) A clear definition of the problem
- 2) Formulation of hypothesis
- 3) Collection and analysis of data and
- 4) Relating the findings to existing theories & earlier formulated hypothesis.

## **CHARACTERISTICS OF RESEARCH**

An understanding of the meaning of research puts us in a position to list the characteristics of research.

1. A research aims at solving a problem.
2. Research is purposive i.e. it deals with a well defined significant problem.
3. A research gathers new knowledge and brings to the forefront hitherto unexplored and unexplained phenomenon.
4. Research involves collection of primary data from first hand sources or involves use of existing data for a new purpose.
5. Research activities are carefully detailed and clearly outlined through a research design. These activities are defined by carefully designed procedures and analysis tools.

6. Research requires a degree of expertise and skill. A research worker is expected to be knowledgeable about the intricacies involved in carrying out a research.
7. Research should be objective and logical. The findings should be free from bias and the results should be carefully verified.
8. Every process, term and tool used in the research should be carefully documented and reported.
9. The research should target towards the discovery of general principles or theories which can find application to a wide range of problems in the present and future context.



## OBJECTIVES OF RESEARCH

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e objective to  
(ii) describe  
se (iv) determine  
ationship.

Research is primarily concerned with production of knowledge. It is the process of discovering the unknown and rediscovering the known. Although every research has its own set of objectives, yet research can be conducted with any of the following four broad objectives in mind :

**I. To Explore.** Research can be carried out with the purpose of gaining familiarity with a particular topic or to gain insight into unexplored areas. Such a research is termed as **exploratory research** and is often carried out before formulating a hypothesis e.g. a domestic company may think of setting up its manufacturing operations abroad. This kind of investment is new to the company and the initial research conducted to explore the possibility of this new idea can be termed as exploratory research.

**II. To Describe.** Quite often a research can be carried out with the objective of describing a particular situation, event or an individual e.g. a study can be carried out to study the voting pattern in a particular state on the basis of gender, economic status, religion etc. as observed in the previous election. Such researches are termed as **descriptive studies**. Since these studies are about events that have already taken place, these studies are also called as **ex-post facto studies**.

**III. To Diagnose.** When a study is carried out with the objective of finding out how frequently a particular event is associated with another event, it is termed as **diagnostic study** e.g. a fast food chain has conducted a research to find out the feasibility of setting up an outlet in a multiplex. The chief objective of this study is to find out that how often people eat their meal outside when planning to watch a movie. Doctors frequently employ diagnostic methods to discover what it is that ails the patient. Numerous questions are asked from the patient and through symptomatic and clinical investigation the doctors can then give a diagnosis. Such studies are called as diagnostic studies.

**IV. To establish Causal Relationship.** A research can be done with the objective of finding out the causal relationship between the dependent variables with independent variables. Such research are called as **hypothesis testing research** e.g. a research carried out to establish the relationship between polio



vaccine (independent variable) and its effectiveness in controlling the occurrence of polio (dependent variable) is a hypothesis testing research.

## TYPES OF RESEARCH

Research can be classified on the basis of purpose, time, methodology, setting etc. However one can broadly classify research as Basic or Applied research.

Research for the sake of enhancing knowledge is termed as basic research

**I. Basic Research.** Research for the sake of enhancing knowledge is termed as basic research. Basic or Pure research is done with the intention of overpowering the unknown. It is an intellectual exploration and the outcome of such research may or may not have any practical relevance. It is primarily concerned with developing and formulating theories and generalisations.

According to Travers<sup>4</sup>, "Basic Research is designed to add to an organized body of scientific knowledge and does not necessarily produce results of immediate practical value." Such a research is time and cost intensive. However the relevance of basic research cannot be undermined. A research, which may not appear to have future utility, may come up with the most startling and unexpected results of high value.

Applied Research is termed as 'need based' research having high practical relevance.

**II. Applied Research.** Applied or practical research is termed as 'need based' research having high practical relevance. The goal of applied research in terms of adding to scientific knowledge base acquires a secondary position. The basic aim of such research is to find solutions to problems being faced by the society, government or the business. Since it is specific in nature, is result oriented and is driven by a clear aim, the time and cost factors are well planned and budgeted. Another form of applied research is **action research**. The difference between the applied and action research is that the former may be taken by a research to find results for a problem being faced by a third party. However action researcher has a condition attached that the researcher is also the practitioner. Hence action research is being undertaken by a researcher to improve upon his own practices.

Data based research in which primary data is collected and the data is analysed and subject to hypothesis testing is called empirical research.

**III. Empirical Research.** This is a data based research in which primary (first hand) data is collected and the data is analysed and subject to hypothesis testing. Often referred to as **experimental research**, the researcher tries to manipulate the independent variables within the research design set by him and then study its effect on the variables under study. The findings from such a research are extrapolated to hold true for the world at large e.g. we may study the effect of a depreciating dollar on Indian export industry. For this purpose we would first establish a relationship between the dollar and export earnings using the available theoretical concepts. Thereafter a sample of export units might be selected and the study is systematically conducted. The findings derived from sample export units would hold true for the whole population i.e. for the entire export sector. Such a research is called as an empirical research.

Qualitative research is concerned with qualitative phenomena generally involving study of human behaviour.

**IV. Qualitative Research.** As the name suggests, this research is concerned with qualitative phenomena generally involving study of human

behaviour. Such a research tries to measure the attitudes and opinions of the people using the technique of interview and observation. Various projective techniques like thematic apperception test, word association test, sentence completion test are used. Such a research is also called as **motivation research**. An example of this kind is the opinion surveys being carried out by a firm to find out the response of the customers to its product and advertisement using any of the above mentioned techniques. Qualitative research is needed in situations where it is not possible to quantify the phenomena and the responses are going to be of subjective nature.

**V. Quantitative Research.** It involves the measurement of a phenomenon in quantitative terms. The results of such research are subject to intensive quantitative and statistical analysis. An example of this kind of research is a study conducted to find out the proportion of school students using self driven vehicles for commuting to school for a given area. Another example of quantitative research is the survey conducted to document the demographic profile of an area and establish patterns between various factors like income and residential area, education and job profile etc. Many a times a debate is carried out about the utility of qualitative research vis-a-vis the quantitative research. Social scientists have often debated upon the correct approach for social research. However it has been seen that there is an inter-dependence between the two. Qualitative research often looks towards quantitative data to support their theories and quantitative research often looks for support in existing theories.

**VI. Longitudinal Research.** Longitudinal research is generally spread over a long period of time. In this kind of study the problem or the phenomena is studied over a consecutive stretch of time e.g. in marketing research a panel of potential consumers can be chosen. They are subject to variations in the advertisement to judge the most effective advertisement campaign and their purchasing behaviour is recorded after exposure to each advertisement. Conclusive results are obtained after observing their behaviour over a considerable stretch of time.

**VII. Simulation Research.** As the word 'simulation' suggests, this research involves the creation of an artificial environment which is very similar to the real environment. Thereafter, within this artificial environment the variables are manipulated and studied. e.g. in order to study the consumer's spending behaviour, he can be given Rs. 1000 and his buying behaviour can be recorded in an outlet very similar to an actual retail environment. Simulation research thus permits us to observe the dynamic behaviour of the consumer under controlled conditions.

Apart from the above classifications research can be classified as *historical research* where old historical matter like documentaries, autobiographies, articles is researched. It can be *conclusion oriented* where the researcher is free to choose a problem of his choice. It can be *decision oriented* where the problem is given to the researcher and he has to work on it to provide the solutions.

Quantitative research involves the measurement of a phenomena in quantitative terms.

Longitudinal research is spread over a long period of time.

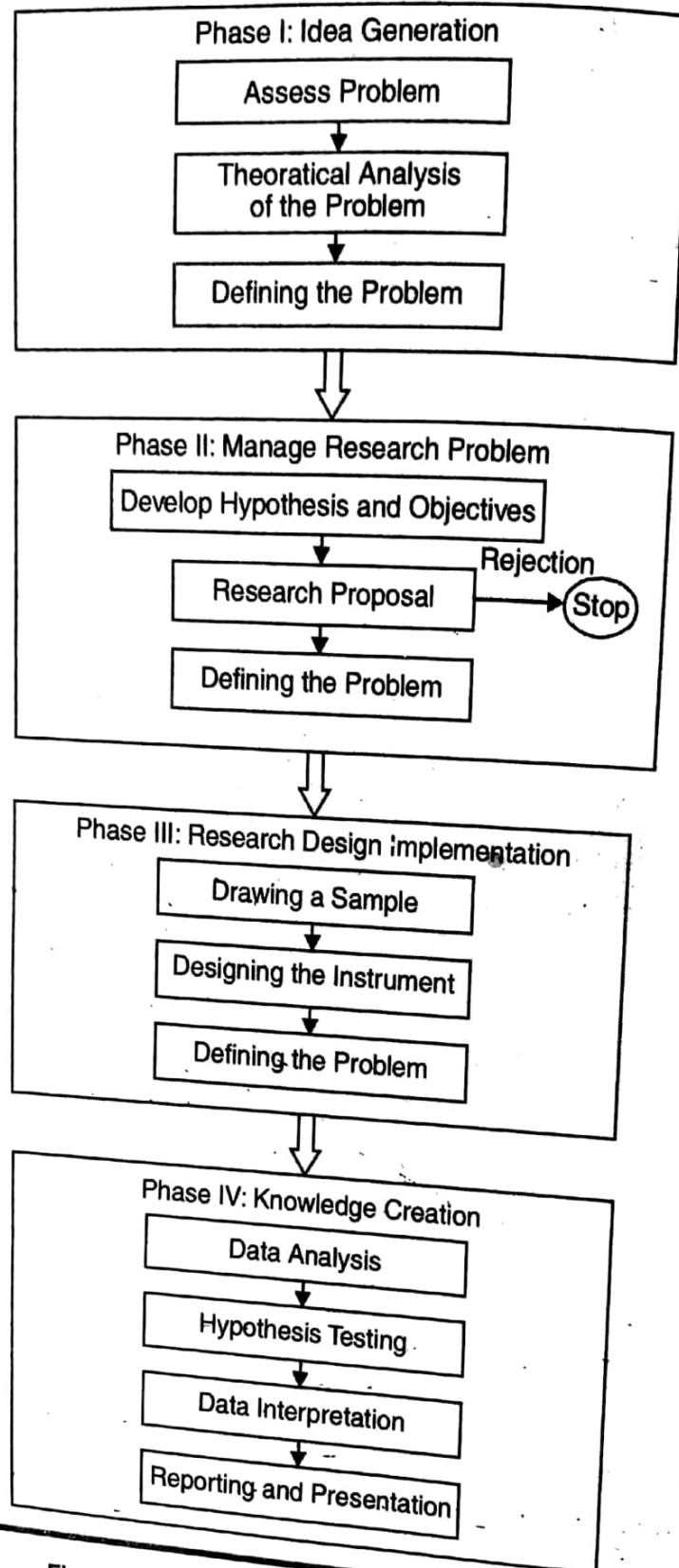
Research involving creation of an artificial environment which is very similar to real environment is called simulation research.

## **RESEARCH PROCESS**

According to Horton and Hunt<sup>2</sup>, the scientific method of research comprises of the following basic steps :

- (i) Defining the problem
- (ii) Review of literature
- (iii) Formulation of hypothesis
- (iv) Developing a research design
- (v) Collection of data
- (vi) Analysis of data
- (vii) Drawing conclusions
- (viii) Replicate the study for generalisations

The various stages of scientific research process are :



**Fig. 1.3. Stages of Scientific Research Process**

These steps give us an idea of the essential steps involved in conducting research. At this stage the research process needs to be discussed in a greater detail. There is no rigid sequence of research process steps. Depending on each situation, certain steps can be skipped, can be repeated or circumvented. However, in spite of all these variations, it is possible for us to develop a sequence of research process. Although each of the steps discussed here are studied in greater detail in subsequent chapters, a brief overview can be

provided at this stage. Figure 1A.1 shows the detailed sequence of research process. Each of these steps is the natural outcome of the previous steps, but these steps are not mutually exclusive. It is possible for instance to develop our research objectives and working hypothesis simultaneously.

## PHASE-I : IDEA GENERATION

**1. Assess Problem Area.** To start a research, we first of all need to discover the problem which demands solution. Any researcher is pretty sure of the subject on which to conduct his research, but the exact problem area may remain elusive. The best way to identify the problem would be to look for an unresolved query, a gap in the existing knowledge or an unfulfilled need within the chosen subject. Although the world is teeming with unsolved queries, yet not every question is suitable for research. Researcher should take care that the problem should be one which can be clearly identified and formulated. Further, while choosing the research area the researcher should look into the availability of information relevant to the topic. Mere availability is not enough, it should also be accessible. Sometimes the information is available but due to the confidential nature of the same, or the cost of obtaining the information being too high, it might not be accessible to the researcher. Hence the researcher should wisely choose the topic of research and show patience and thoroughness in finalizing the topic.

**2. Theoretical Analysis of the Problem.** The next step is to become familiar with the problem and formulate it clearly. Literature survey involves a comprehensive review of published and unpublished work from the secondary sources of data available in the relevant area of study. The researcher at this stage may review all the available conceptual literature concerning the theories and concepts related to the problem as well as the empirical literature comprising of studies done earlier and bearing similarity to the problem under study. It is also possible for the researcher to get in touch with people who have authored books or conducted research relevant to his area of study. Literature review helps the researcher in two ways ; firstly it helps him in specifying his research problem in a meaningful context, secondly it would provide him with an insight into the methods and techniques adopted for handling such problems. The researcher can either access *bibliographic databases* which display only the bibliographic citations like name of the author, title of the book, publisher, year, volume and page number. He can also use *abstract database* which along with bibliographic citations also provides him with an abstract of the article. The researcher can also use *full text databases* which contain the entire text.

**3. Problem Definition.** Initially the focus of the problem is ambiguously defined. However after the literature review, the researcher is now in a position to formulate his problem clearly.

In the words of Albert Einstein<sup>3</sup> "The formulation of a problem is far more essential than its solution, which may be merely a matter of mathematical or experimental skill".



METHODOLOGY

A problem well formulated will alone yield fruitful results. The right answers for the wrong questions have no value. It is a clear, precise, and concise statement of the matter that is to be investigated. The problem statement is a fact oriented information gathering question. The objectives of the study at this stage are clearly developed.

## PHASE-II : MANAGE RESEARCH PROBLEM

**4. Developing Hypothesis and Objectives.** A hypothesis is a tentative assumption regarding the solution to the problem under study. The hypothesis is the focal point around which the future research efforts will be directed. The kind of data to be collected, the tools of analysis are influenced by the hypothesis. The hypothesis is a predictive statement which is made in the light of the available facts relating to the problem under study. e.g. a study conducted to find the amount of research investment being done by the companies will have the following hypothesis :

$H_0$  : Companies invest 1 % of their sales revenue in research activities.

$H_a$  : The companies spend less than 1 % of their sales revenue.

The  $H_0$  is called as the null hypothesis which assumes there is no difference between the population parameter and the sample mean and the  $H_a$  is called as the alternative hypothesis which presents the alternative solution. A hypothesis thus presents a relationship between the different variables. In case of social research relating to human behaviour, the hypothesis helps us in making a prediction about the population parameter. A hypothesis serves as a guide to the researcher and helps him in maintaining a focus on his study.

**5. Research Proposal.** A research proposal is a brief summary outlining the objectives of study and the modus operandi of conducting the research. In case of a thesis, the research proposals are in the form of a synopsis stating the research objectives, the proposed methodology of research, benefits of study along with a detailed bibliography. In case of business or government organizations the research proposal, in addition to the above information will contain information about the researcher's qualification, the time and cost schedules, the resources and special facilities required during research. Essentially they contain an executive summary, right in the beginning stating the objective of the study and benefit derived thereon. Research proposal is very important and should be prepared carefully especially when it is to be reviewed by the concerned authorities for approval to conduct further research. Apart from it the research proposal is like a road map to the researcher showing where he has to start and where to go and how to get there.

**6. Research Design.** Once the researcher is given the go-ahead, the next step is to work out the research design in detail. Research design outlines the conditions for collection and analysis of data. The what, when, where, how much and the method of data collection are detailed in the research design.

It will specifically contain information about :

(a) The Sampling Design

(b) Instrument Design

(c) Data Collection Design

**(a) The Sampling Design.** While conducting the research all the items which are a part of the study constitute the universe of research. If a research involves the study of each and every unit of the population, it is termed as a census survey. However it is generally not feasible to conduct a complete enumeration survey, especially if the universe of the study is very vast. e.g. TRPs of TV programmes are developed on a sample basis rather than covering all the households of an area. Hence a part of universe is studied by drawing a sample and the plan devised to draw a sample is termed as sampling design. A sampling design will include a decision on the sampling unit, the sample size and the sampling method.

**'Sampling unit'** is the most elementary unit which would be a part of the study e.g. in a survey on newspaper readership pattern, a single household comprising of all the members of the household can be regarded as a sampling unit. In another study on consumer preference for soft drinks an individual can be the sampling unit of the study.

Next a decision on **'the size of the sample'** is taken. The size depends on factors like the availability of time and funds to the researcher, the ability of the researcher, the size of the population and the nature of the population e.g. a homogeneous nature of the population calls for a small sample size whereas a heterogeneous population can be represented adequately by a large sample size only. The important thing to remember is that the sample size should be such as to adequately represent the population.

**(b) Instrument Design.** Instrument refers to the questionnaire or the schedule that the researcher would use to collect data. The researcher while designing the questionnaire must think in terms of :

1. **Type of Data.** It determines whether the data will be collected in a nominal, ordinal, interval or ratio form. A nominal data has no order, distance or origin, ordinal data has an order but no distance and origin, an interval data has order and distance but no origin and a ratio data has order, distance as well as a unique origin.
2. **Communication Approach.** Before designing the instrument the researcher has to decide on how to collect the data i.e. through mailed questionnaire, interview or observation e.g. in case of a questionnaire the researcher might use some graphic questions which would not be possible if the telephonic method of interview was used.
3. **Question Structure.** This decides the type of questions and their order. The instrument can be completely structured having a set of direct questions arranged systematically or it could be an indirect unstructured questionnaire where the questions are arranged haphazardly in indirect manner. It could also be a combination of the above two approaches.



4. **Question Wording.** It should be the endeavor of every researcher to have questions with simple words leaving no scope for ambiguity. Long questions are to be avoided and the wording should not be biased.

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(c) **The Data Collection Design.** The method of gathering the data is planned in data collection design. The data can be collected through an experiment conducted in controlled settings or it can be conducted through field survey. The survey can be a simple one involving data collection from one source or it could involve areas spread all over the world. Hence a well planned data collection design becomes necessary.

### PHASE-III : RESEARCH DESIGN IMPLEMENTATION

7. **Drawing a Sample.** A researcher can use a non-probability method or a probability method of sampling. In case of **non-probability method** of selecting a sample, an element of bias is involved. The probability of a unit being a part of the sample is not known.

Under this method one can adopt :

- (i) **Convenience sampling** where information is collected from people who are conveniently available e.g. our colleagues, neighbors or friends.
- (ii) **Purposive sampling** where certain specific people are deliberately made a part of the sample.
- (iii) **Judgement sampling** where the choice is made of subjects who are so placed as to provide the best information.
- (iv) **Quota sampling** is like purposive sampling, except that it ensures that a group is adequately represented through the assignment of quotas.

**Probability method** of sampling involves giving every member a known and unbiased chance of being a part of the sample. Few probability methods are:

- (i) **Simple random sampling** where using lottery method or random tables every unit is given an equal chance of being selected.
- (ii) **Stratified sampling** is used when the population has distinct categories or stratas e.g. on the basis of gender, population can be divided into males and females. If the proportion of members from different stratas in the sample from different stratas is the same as in proportion in the population it is termed as proportionate stratified sampling, else disproportionate stratified sampling.
- (iii) **Cluster sampling and area sampling** are two methods in which population forms clusters on the basis of some characteristics. The population is divided into clusters or segments and the entire cluster is chosen randomly. Area sampling is a case of cluster sampling where segments have been drawn on the basis of geographical area and the entire area is made a part of the sample.

- (iv) **Systematic sampling** involves choosing the sample according to a pre-determined series e.g. every tenth item on the electoral rolls can be made a part of the sample.

**8. Designing the Instrument.** Decision on the instrument has been made earlier in research design. The researcher will now design it and subject it to *pilot testing*. Pilot testing detects the weakness in the design and content of the instrument. It involves selecting a small sample from the target population and simulating the procedures for data collection that have been designed. Any weakness so discovered would be corrected and the revised instrument would then be used for final research.

**9. Data Collection.** The research now has the option of collecting data using any of the following methods :

(a) **Questionnaire.** A set of questions pertaining to the topic under study are compiled and the questionnaire is then mailed to the respondent through mail. This method of data collection is particularly used in situations where a large number of respondents are to be covered and they are spread over a wide area. This method is time saving and economical. The main drawback of this method is that the non-response rate is very high. These days e-questionnaire is used where the response is sought on-line through e-mail.

(b) **Interview.** An interview method involves a direct interaction between the respondent and the researcher/field workers. The interview can be a personal interview where the researcher personally asks questions from the respondent or it can be a telephonic interview. In case of telephonic interview the respondents are contacted on telephone. This method is adopted where the respondents are spread over a wide area and time available is very less. An important thing to remember is that while conducting an interview the researcher uses an interview schedule which is like a questionnaire. An interview schedule contains a set of questions and the researcher records the answer in his own hand, or through the use of some audio-visual tool.

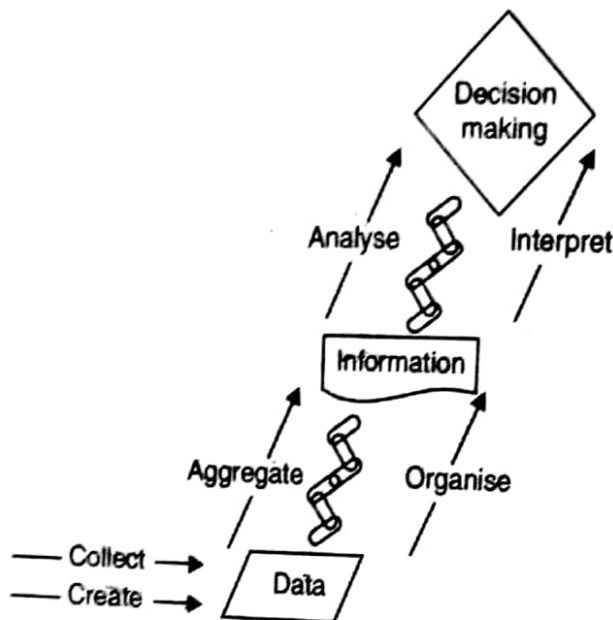
(c) **Observation.** Observation involves collecting data visually and recording the event. Observation besides visual aspect also involves listening, smelling and touching. All behavioural activities as well as non-behavioural activities like physical condition analysis, processes, records can be analysed through observation. An observation also involves the use of observation schedules which contains a list of all the items that are to be observed.

## **PHASE-IV : KNOWLEDGE CREATION**

From this stage onwards the researcher moves forward from the planning stage to data gathering stage. This involves sending questionnaires to respondents, training field workers in interview and observation methods. Training can be given at a focal point through seminars or instruction manuals. A careful control over the data collection process is maintained. Respondents who have remained incommunicado in the first round of communication are once again contacted. The researcher would also be doing sudden field checks

to ensure that field workers are adhering to the instructions detailed to them. The basic aim in this stage is that the data is collected in the correct form and within the specified schedules.

**10. Analysis of Data.** All the data gathered in the previous step has no meaning till the time it is not subject to data analysis. Processing of this raw data will yield some kind of relevant information. As can be seen in Figure 1.5 the raw data when it is aggregated, organized and analysed yields us some information which helps us in decision making.



**Fig. 1.4 :** Decision Making Through Data Analysis

Data analysis is concerned with reducing the bulk of accumulated data to a manageable size. Generally speaking it involves the following procedures :

- (a) **Coding.** Data is generally gathered using questionnaire or schedules. Under this process the various responses of the respondents are coded using symbols e.g. respondents can be classified in term of education using symbol of L(Literate) or IL(Illiterate). The basic purpose of coding is that it allows the researcher to group the responses in well defined categories which then become easy to tabulate.
- (b) **Editing.** The next step is the editing of response. Many times the response given by the respondent is either incomplete, incomprehensible or is written in short hand. Editing removes ambiguities regarding responses, shunts out the invalid responses and thus improves the quality of data for statistical analysis.
- (c) **Tabulation.** It is the process of putting the classified data in the form of tables. Tables can be one dimensional where data is tabulated in terms of one feature e.g. sales figure in terms of time. They can be multidimensional where data is tabulated using two or more features e.g. sales figure in terms of time, region and product are depicted simultaneously in a table.

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- (d) **Statistical Analysis.** In the last stage, the tabulated data is analyzed using various statistical techniques like averages, percentages, trend analysis, co-relation and regression techniques etc. Statistical analysis these days has become highly dependent on computers and softwares that are readily available in the market.

**11. Hypothesis Testing.** Post analysis of data researcher will now move ahead to test the hypothesis that he had formulated in the beginning of the research process. There are various parametric and non-parametric tests like t-test, z-test, f-test, kruskal-wallis test, wilcoxon-Man-Whitney test etc. The choice of test selected for hypothesis testing depends on factors like the nature and objective of research, characteristics of population distribution, the sampling technique, type of data etc. Hypothesis testing will help a researcher in establishing the validity of his results. It would help him to state clearly that whether the difference, if any, between the two values is due to chance and hence can be attributed as insignificant or if the difference is actual and significant. It will help in determining whether the difference is real or simply an outcome of random fluctuations.

**12. Data Interpretation.** For studies in which no hypothesis has been tested, data interpretation is done with the intention of seeking explanation for the research results on the basis of existing theories. The results are interpreted in the light of existing theories and doors are thrown open for newer explanations and possibilities for further research. In case of hypothesis testing research studies, after the data has been analysed and tested repeatedly for arriving at conclusive results, generalizations are made to build a new theory. Such generalizations come up with better explanation and new theories for existing phenomenon and greatly contribute to the existing data bank.

**13. Reporting and Presentation.** The last step is concerned with bringing in public the results of the research so that the findings can be put to some use. The style and method of reporting would depend on the target audience, the purpose and the time of reporting the results. Any research report whether it is presented in a detailed form or in the form of a brief note should essentially have the following contents.

- The **preliminary section** containing the title of the report, table of contents, list of tables, graphs, preface and an executive summary, which gives briefly the research objectives and the findings and importance of the study.
- A **main text** section which contains the problem background, research objectives, a note on research methodology used, the importance of conducting the research and the conclusion arrived thereof. A special mention of the recommendation given by the researcher in light of the findings made by him should also be included.
- The **end section** which includes appendices supporting the research with items like questionnaires and schedules used, glossary of terms and any other matter which although not a part of the main research but required in order to support the research can be included.

# The formulation of objectives

Objectives are the goals you set out to attain in your study. Since these objectives inform a reader of what you want to achieve through the study, it is extremely important to word them clearly and specifically.

Objectives should be listed under two headings:

- main objectives;
- subobjectives.

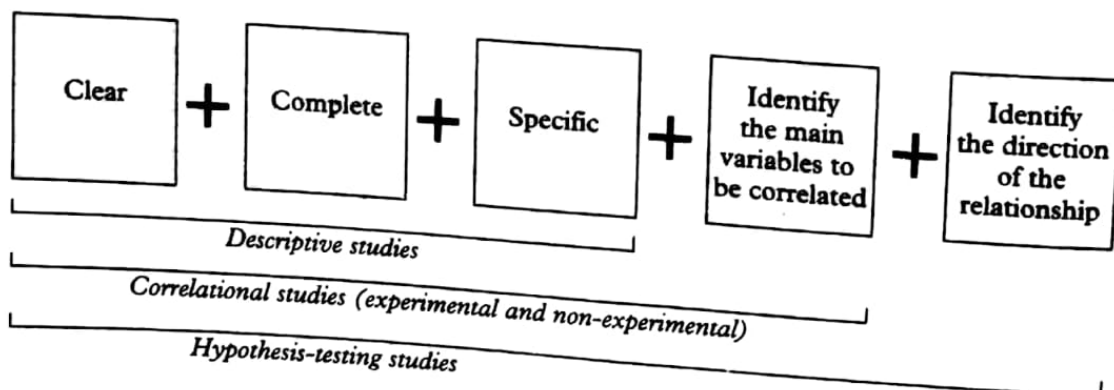
The main objective is an overall statement of the thrust of your study. It is also a statement of the main associations and relationships that you seek to discover or establish. The subobjectives are the specific aspects of the topic that you want to investigate within the main framework of your study.

Subobjectives should be numerically listed. They should be worded clearly and unambiguously. Make sure that each subobjective contains only one aspect of the study. Use action-oriented words or verbs when writing your objectives. The objectives should start with words such as 'to determine', 'to find out', 'to ascertain', 'to measure' and 'to explore'.

The way the main and subobjectives are worded determines how your research is classified (e.g. descriptive, correlational or experimental). In other words, the wording of your objectives determines the type of research design you need to adopt to achieve them. Hence, be careful about the way you word your objectives.

Irrespective of the type of research, the objectives should be expressed in such a way that the wording clearly, completely and specifically communicates to your readers your intention. There is no place for ambiguity, non-specificity or incompleteness, either in the wording of your objectives or in the ideas they communicate. Figure 4.5 displays the characteristics of the wording of objectives in relation to the type of research study.

Figure 4.5 Characteristics of objectives



If your study is primarily descriptive, your main objective should clearly describe the major focus of your study, even mentioning the organisation and its location unless these are to be kept confidential (e.g. to describe the types of treatment program provided by ... [name of the organisation] to alcoholics in ... [name of the place] ... or to find out the opinion of the community about the health services provided by ... [name of the health centre/department] in ... [name of the place] ... ). Identification of the



organisation and its location is important as the services may be peculiar to the place and the organisation and may not represent the services provided by others to similar populations.

If your study is correlational in nature, in addition to the above three properties, the wording of the main objective should include the main variables being correlated (e.g. to ascertain the *impact of migration* on *family roles* or to compare the effectiveness of *different teaching methods* on the *comprehension of students*).

If the overall thrust of your study is to test a hypothesis, the wording of main objectives, in addition to the above, should indicate the direction of the relationship being tested (e.g. to ascertain if an *increase in youth unemployment* will *increase the incidence of street crime*, or to demonstrate that the provision of maternal and child health services to Aboriginal people in rural Australia will *reduce infant mortality*).

### 3.11 SURVEYS

#### Meaning

Survey is a 'fact finding' study. It is a method of research involving collection of data directly from a population or a sample thereof at particular time. It must not be confused with the mere clerical routine of gathering and tabulating figures. It requires expert and imaginative planning, careful analysis and rational interpretation of the findings.

Data may be collected by observation, or interviewing or mailing questionnaires.

The analysis of data may be made by using simple or complex statistical techniques depending upon the objectives of the study.

#### The Characteristics of Survey Method

The survey method has certain characteristics:

1. It is always conducted in a *natural setting*: it is a field study.
2. It seeks *responses directly* from the respondents.
3. It can cover a very *large population*, thanks to sampling techniques.
4. A survey may involve an *extensive* study or an *intensive* study. An extensive study covers a wider sample. An intensive one covers a few samples and tends to 'dig deeper'. These two approaches serve different ends; where generalization or estimation is necessary, the extensive approach is useful, but where one wants to make an indepth study of some aspects of a subject-matter, the intensive approach is preferable.
5. A survey covers a definite *geographical* area: a city, or a district, or a state.

The quality of a survey depends upon the thoroughness of the planning, the soundness of sampling, the adequacy and reliability of data, the quality of analysis and the interpretation of the findings.

#### Steps Involved in a Survey

The sequence of the tasks involved in carrying out a survey from the first of planning to the final stage of preparing the report is presented below:

1. Selection of a problem and its formulation,
2. Preparation of the research design,
3. Operationalisation of concepts and construction of measuring indexes and scales,
4. Sampling,
5. Construction of tools for collection of data and their pre-test,
6. Field work and collection of data,
7. Processing of data and tabulation,



8. Analysis of data, and

9. Reporting.

All these steps are discussed in detail in the relevant chapters.

## The Purposes of Surveys

Survey serves several purposes:

1. The purpose of many surveys such as population census, socio-economic surveys, expenditure surveys, marketing surveys etc., is simple to *provide information* to government or planners or business enterprises. These surveys have a *descriptive* purpose. In short, all fact-finding surveys have this purpose.
2. Many enquiries aim to *explain* certain phenomena. Their function is to test hypotheses, to explain the causal relationships between variables and to assess the influences or various factors on a given phenomenon like job-satisfaction, labour productivity and consumer behaviour. Surveys aiming at explanation involve indepth analysis and complex interpretations.
3. Surveys may be designed to make *comparisons* of demographic groups (e.g., comparison of low income groups with high income groups) or real groups, e.g., work groups in factories or offices. Comparison of behavioural or attitudinal groups can also be made. For example, in a factory, the attitudes of high-production workers toward the company may be compared with the attitudes of low-production workers.
4. Surveys concerned with *cause and effect relationships* can be useful for making *predictions*. For example, if relationships between income increases and purchase of durable goods are established in a consumer behaviour survey, a prediction about future demand for durable goods with reference to anticipated income increases can be made. A survey of people's future plans and intentions is another approach to make predictions. This is one of the methods adopted for demand forecasts.

### 3.12 CASE STUDY

#### Meaning

A case study is an *in-depth* comprehensive study of a person, a social group, an episode, a process, a situation, a programme, a community, an institution or any other social unit.

It is one of the most popular types of research methods. Its purpose may be to understand the *life cycle* of the unit under study or the *interaction* between factors that explain the present status or the development over a period of time. Some examples of a case study are: a social-anthropological study of a rural or tribal community; a causative study of a successful cooperative society; a study of the financial health of a business undertaking; a study of labour participation in management in a particular enterprise; a study of juvenile delinquency; a study of life-style of working women; a study of slum dwellers; a study of urban poor; a study of economic offenses; a study of refugees from another country.

#### Functions

The case study method describes a case in terms of its *peculiarities*. It gives us an insight into the *typical* or *extreme cases* whose unique features are not reflected by the usual statistical method.

A case study helps to secure a wealth of information about the unit of study, which may provide clues and ideas for further research. It provides an opportunity for the *intensive analysis* of many specific details that are overlooked in other methods.

It examines *complex* factors involved in a given situation so as to identify *causal* factors operating in it.

A case study aims at studying *everything* about something rather than something about everything as in the case of a statistical method.

While in a statistical approach the 'individual' disappears from the analysis, in a case study the 'individual' representing the 'wholeness' is *preserved*, as it is an approach which views any social unit as a whole. Thus, a case study gives us a *total view* of a unit or a *clear insight* into a situation or process in its total setting. Thus, the perspective of a case study is both qualitative and organic. It gives an overall generic picture of a problem.

The case study, as a research method, often employs more techniques than one. Thus, for tracing a developmental process, it uses historical method, it employs descriptive method where a factual picture is needed, it employs interviewing, mail questionnaire, check lists, rating scales, etc., to gather data, it looks to statistics for testing hypotheses.

The aim of a case study is to ascertain the *generic* development of a social unit under study, revealing the factors that moulded its life within its cultural setting. Because of its aid in studying behaviour in specific, precise detail, Burgess termed the case study method as "*the social microscope*."<sup>21</sup>

It is most *valuable* for diagnostic, administrative and therapeutic purposes.

It develops ideas, sometimes *leading to conclusion* and sometimes to *hypotheses* to be tested. It may also be useful for developing new concepts or testing existing concepts.

## 7.5 OBSERVATION

### Meaning and Importance

Observation means viewing or seeing. We go on observing something or other while we are awake. Most of such observations are just casual and have no specific purpose. But observation as a method of data collection is different from such casual viewing.

Observation may be defined as a systematic viewing of a specific phenomenon in its proper setting for the specific purpose of gathering data for a particular study. Observation as a method includes both 'seeing' and 'hearing'. It is accompanied by perceiving as well.

Observation is a classical method of scientific enquiry. The body of knowledge of various natural and physical sciences such as biology, physiology, astronomy, plant ecology etc. has been built upon centuries of systematic observation.

Observation also plays a major role in formulating and testing hypothesis in social sciences. Behavioural scientists observe interactions in small groups; anthropologists observe simple societies, and small communities; political scientists observe the behaviour of political leaders and political institutions. In a sense, as the Webbs<sup>1</sup> have pointed out, all social research begins and ends with observation. A researcher silently watching a city council or a trade union committee or quality circle or a departmental meeting or a conference of politicians or others picks up hints that help him to formulate new hypothesis. He can test them through further observation and study.

Observation becomes scientific, when it (a) serves a formulated research purpose, (b) is planned deliberately, (c) is recorded systematically, and (d) is subjected to checks and controls on validity and reliability. Validity refers to the extent to which the recorded observations accurately reflect the construct they are intended to measure. Validity is assessed by examining how well the observations agree with alternative measures of the same construct. Reliability entails consistency and freedom from measurement error. This is usually assessed in terms of (a) the extent to which two or more independent observers agree in their ratings of the same event; and (b) the repeatability of observations over time by means of test-retest comparisons. (For detailed discussion see section 5.6 of Chapter 5).

Green, 1932, p. 158.

Despite these developments research in India has met with certain roadblocks like :

**I. Availability of Qualified Personnel.** Research is a complex work demanding qualified personnel. In India large part of academic research is carried out by people who are unaware about research procedures and methods. India does not lack in qualified personnel but more often than not, they get attracted by offers made by foreign research institutions. Whether it is the lack of technical infrastructure or better remuneration, the fact of the matter is that we are losing out on our wealth of researchers to foreign shores. India needs to develop as well as retain skilled researchers.

**II. Liaison between Academia, Business and Government.** Presently the tie-up between the research cells at various universities and the government and business is very poor. With the exception of few premier academic institutes, research carried out by most other institutions finds little relevance in government and business circles. A proper liaison will not only give direction to research but will also address the problem of paucity of funds.

**III. Paucity of Funds.** The third major problem is that very few funds find their way into research activities. It has been seen that except for few business houses, even the business organizations do not spend more than 1% of their sales revenue on research against a desired of 10%. As mentioned earlier, if there is a well developed tie-up between government and business on one side and universities on the other side we will find a large number of sponsors for research.

**IV. Information Data Bank.** In the age of computers it is very necessary that there should be centralised databases available. Currently we find that lot of research is repetitive in nature because there is no centralised databank where information on research work already done can be obtained. Further while doing research a centralised databank of journals, magazines, international and national journals, books etc helps a researcher to save on time and cost factor. There are institutions like UGC, CMIE etc. which have maintained such a database of online reference material. Its use however has yet to gain momentum since it is available at select institutions and in certain cases at a high cost.

**V. Ethics in Research.** A very serious allegation on many researches done in our country is that it is based on 'reverse engineering' or the cut and paste method. It is necessary that we break free of such practices and show honesty in our research. A research involving collection of primary data should not be cooked up but be genuinely collected from the field. It should be our endeavor to conduct authentic research in an ethical manner.

## SOURCES OF SECONDARY DATA AND ITS COLLECTION AND ORGANISATION

The different sources of secondary data have been shown in Figure 7.1. The secondary data can be collected from two sources (a) internal sources. (b) external sources. Internal sources generates internal data which refers to the data that has been generated from within the organisation for which the research is being done *e.g.* a company's annual reports are internal data for the company. External sources generate external data which refers to the data that is generated outside the organisation for which the research is being done *e.g.* the census data used by a social researcher, or data taken from a journal or magazine not published by the organisation.

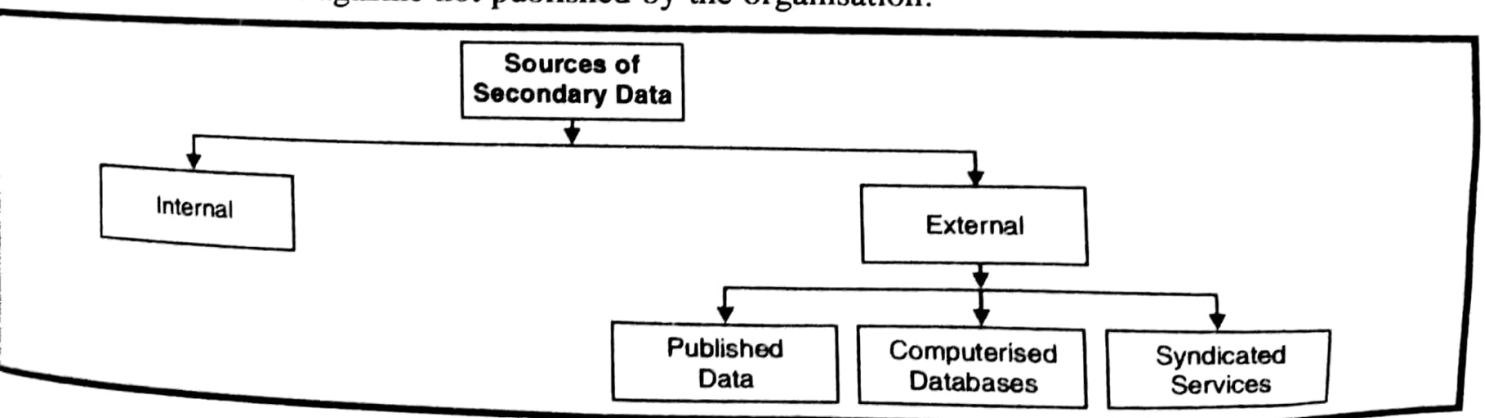


Fig. 7.1 Types of Secondary Data

## I. Internal Data

The data which is available internally within the organisation conducting research is termed as internal data. The main advantage of this data is that it is easily available and greater reliance can be placed on the degree of accuracy and relevance to the study *e.g.* a social researcher belonging to NGO might be carrying out a research on 'awareness of human rights in women'. Then if the NGO database has any information on status of women, their awareness level, then this data would be classified as internal data. Internal data may be ready to use or require further processing *e.g.* if a study has been conducted on awareness levels in women then this data can be used directly. However if the database has just the record of cases where women have stood up for their basic human rights then the researcher would have to work out the level of awareness from this data. Thus whereas the former data is available in a ready to use form, the latter requires further processing before it can be incorporated into the research. Internal data has two significant advantages, firstly they are the least costly of the secondary data types and secondly they are easily available.

## II. External Data

External data is the secondary data that is available from outside the organisation for which the research is being conducted. It can be classified as (a) published data (b) computerised databases and (c) syndicated services.

(a) **Published Data.** These are the most popular of the external sources of data. There is always a plethora of published data available to a researcher.

Different sources of published data are :

- **Guides** – They are a source of standard recurring data. They generally act as a good starting point for the search for secondary data. Some useful guides are Asian Social Science Bibliography which covers an annual bibliography of selective english language publication. Indian National Bibliography prepares the monthly list of documents, both official and non official documents, that are published in India.
- **Directories** – They generally contain a list of all the related organisations or sources of further data *e.g.* the Directory of Social Science Research Institutions and Directory of Professional Organisation in India. There is the National Register of Social Scientist in India which contains information on scholars who have contributed through teaching and research in social science.

Thus these guides, directories and indexes serve as a good starting point for researcher to look for published external data.

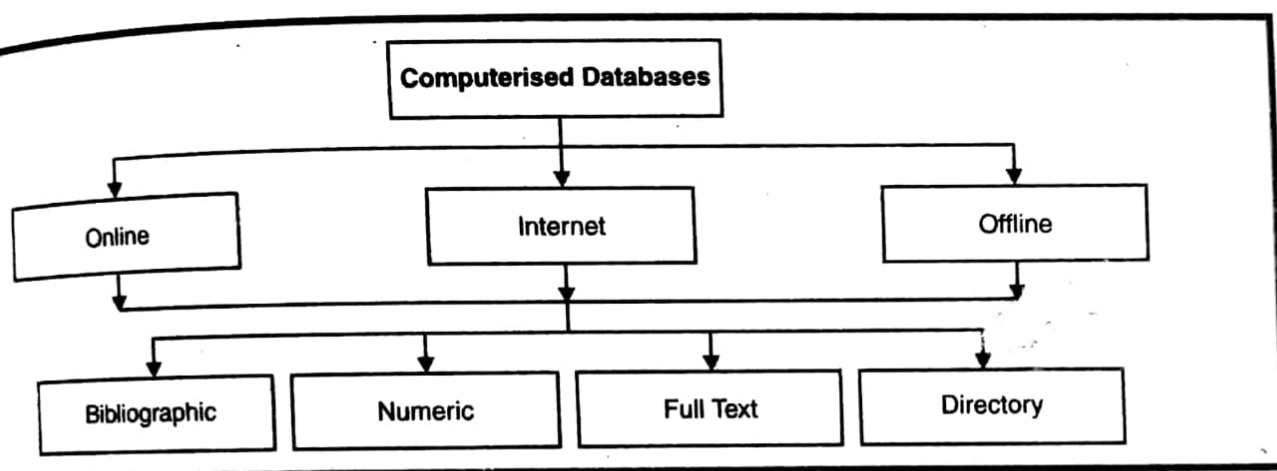
- **Government sources** like the census data, Economic Survey data are also good sources of external published data. The government periodically brings out information on various economic and social indices of the country which can provide valuable data to the researcher.



Computerised databases available to the data which is available in an electronic form. It can be classified as (a) online (b) internet (c) offline database.

**(b) Computerised Databases.** Computerised databases refer to the data which is available in an electronic form. Computer databases can be classified in various type on the basis of the form in which they are lying in the storage media as shown in Figure 7.2.

Broadly speaking there are three distinct categories (i) online database (ii) internet database, and (iii) offline database. Online database refers to data which is lying in a central data bank and can be accessed from anywhere through a telecommunications network. Internet database refers to the data which can be accessed, searched and retrieved from the internet. An internet data when downloaded and stored on a secondary storage becomes an offline data. Offline database is the data which is available on various storage media like diskettes CDs and DVDs. These databases can be accessed from these media through a personal computer.



**Fig. 7.2** Classification of Computer Databases

Computer database can be in the from of :

- **Bibliographic Database :** They are composed of citation to articles in journals, magazines/newspapers, marketing research studies, technical reports, government documents and the like.<sup>1</sup> Generally these database have information available in an abstract form or a summary form.
- **Numeric Database :** They are the numerical and statistical database. They may be economic data that is provided in a time series form *e.g.* the census data is a type of numeric data.
- **Full text database :** They contain the complete text of the document. Generally archives of newspapers lie in a full text form. A researcher can retrieve the complete article form a newspaper online data base.
- **Directory Database :** As the name suggests, it provides a complete listing of individuals, organisations or services *e.g.* manufacturing association of various industries provides online as well as offline listing of all the member firms.

The amount of information available to a researcher on computer databases is overwhelming and it becomes cumbersome to sort through such a large

amount of data. Hence a strategy should be designed by a researcher to conduct a database search.

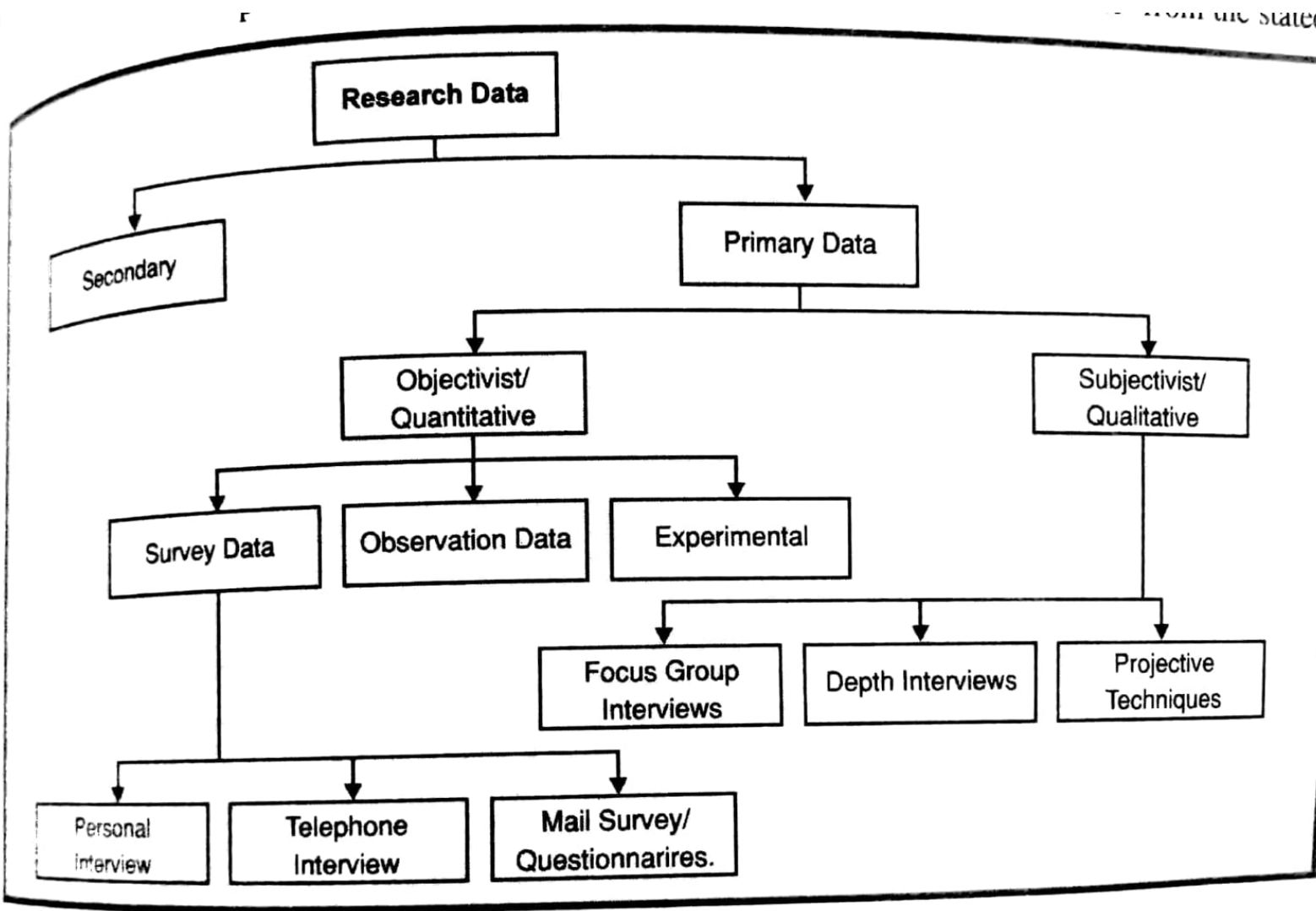
The following strategy may be followed for conducting database search:

1. The first step is to develop key words which will be entered into the system for actual search *e.g.* if you are looking for inflationary trends in India : then the key search words are Inflation and India.
2. In the next step you log on to the desired database and feed in the key search words that have been identified in previous step.
3. The results displayed should be viewed by the researcher critically in terms of their suitability. He should see if the detail provided by the search matches his criteria. Once satisfied the results can be stored or printed.

**(c) Syndicated Services.** These refer to companies that collect and sell data to various clients having different information needs. Myers and Mead<sup>2</sup> have stated that "Syndicated services are provided by certain organisations which collect and tabulate marketing information on a continuing basis." The data collected by them has the ability to suit the requirements of a large number of individuals or organisations, *e.g.* in India, Centre for Monitoring Indian Economy (CMIE) is an organisation that collects large amount of economic data and any individual or firm can avail the use of this data by paying a certain charge.

The information collected from syndicated services has the advantage that it is current in nature, a characteristic generally associated with primary data, and the per unit cost of the data to the client (researcher) is less than if he had to collect it by himself. At the same time this information is collected by any organisation other than the researcher, a characteristic of secondary data, it has the disadvantage that the client (researcher) does not enjoy any exclusive advantage since the same information is available to others also.

Other than the syndicated sources, there are several research agencies like Ernst & Young, who undertake research activities exclusively for a client on his behalf. This data although collected by an outside agency is the sole property of the client. However the cost of this data will be relatively more than that provided by syndicated services.



## **INTERVIEW**

Interview is the verbal conversation between two people with the objective of collecting research relevant information.

A form of communication approach to collecting data from respondents, interview refers to oral or verbal questioning. Bingham and Moore<sup>1</sup> have described interview as 'conversation with a purpose.' Lindzey Gardner<sup>2</sup>, has defined interview as a "two-person conversation, initiated by the interviewer for the specific purpose of obtaining research-relevant information and focussed by him on the content specified by the research objectives of description and explanation." It is thus clear that interview is a verbal conversation between two people with the objective of collecting research relevant information from the respondent. Interview can be classified into various types viz., personal interview, telephone interview, focus group interview, depth interview and projective techniques also called as indirect interviewing.

### **I. Types of Interview**

The interview techniques can be grouped in the following categories.

A personal interview is a face to face two way communication between the interviewer and the respondent.

**(a) Personal Interview.** A personal interview is a face to face two way communication between the interviewer and the respondent. Generally the personal interview is carried out in a planned manner and is referred to as 'structured interview'. The personal interview can be conducted in many forms *e.g.* door to door interviewing where the respondents are interviewed in their home, or as a planned formal executive meeting, most commonly used to interview officials and business persons, or as a small intercept survey where respondents are interviewed at select places where the chances of finding respondents is maximum.

**(b) Telephone Interview.** In telephone interviewing the information is collected from the respondent by asking the questions on phone. The marriage of telephone and computer has made this method even more popular. Traditional telephone interviews call for phoning a sample of respondents, asking them questions written on a paper and recording them with a pencil. In case of 'Computer Assisted Telephone Interviewing' (CATI) uses a computerised questionnaire is used which prompts the interviewer with introductory statements, and qualifying questions to be asked to the respondents. The computer replaces the paper and pen. The computer randomly dials a number from the sample, upon contact the interviewer reads the questions and enters them directly into the computer's memory bank.

Focus group interview is an unstructured interview which involves a moderator leading a discussion between a small group of respondent on a specified topic.

**(c) Focus Group Interview.** A kind of unstructured interview, it involves a moderator leading a discussion between a small group of respondents on a specified topic. A focus group interview involves 8 to 12 respondents having homogeneous characteristics, seated in a comfortable relaxed informal atmosphere. The interview generally continues for 1 to 3 hours during which the respondents develop a rapport and share their views. The proceedings are recorded on an audio or visual device. The moderator keeps the discussion going and probes the respondents whenever necessary to elicit insightful responses. These responses are better analysed to derive conclusive results.

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However, like the two sides of a coin, focus group interview suffers from certain disadvantages like, the results can be wrongly interpreted since the response is not to any specific question. Focus group interviews make coding and analysis of data also very difficult. Most importantly, it is difficult to find a moderator who can conduct these interviews successfully.

**(d) Depth Interviews.** Depth interview, like the focus group interview in an unstructured type of interview used to collect qualitative data. However it involves a one to one interaction between the interviewer and respondent. The depth interview can be 'non directive in nature where the respondent is given freedom to answer within the boundaries of topic of interest.' The other form of depth interview is 'semistructured' in nature where the interviewer covers a specific list of topics although the linking, the sequence and the wording of each question is left to the interviewer's discretion.

In depth interviews, the interviewer asks the initial questions and thereafter it is the response of the respondents from which further questions may be generated. The interviewer using probing techniques looks for more elaboration. The interviewer only follows a rough outline of questions. The depth interviews have the advantage of uncovering much deeper feelings and insights than focus group interviews, since they are dealing with just one respondent. However it suffers from the drawback of being expensive, time consuming and demands skilled interviewer.

**(e) Projective Techniques.** The techniques involve highly unstructured and indirect form of questioning. The central feature of all projective techniques is the presentation of an ambiguous, unstructured object, activity or person that a respondent is asked to interpret and explain.<sup>5</sup> These techniques are best suited in situation where the respondent is not sure of his feelings and hence cannot express his answers directly. The projective techniques can be classified as construction techniques, association techniques and completion techniques.

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## MAIL SURVEY/QUESTIONNAIRE

A questionnaire is a form containing a set of questions, which are filled by the respondents.

According to **Goode Hatt**,<sup>6</sup> "In general, the questionnaire refers to a device for securing answers to questions by using a form which the respondent fills in himself."

A questionnaire is a form containing a set of questions which are filled by the respondents.

The *objective of a questionnaire* is two fold :

- To collect information from respondents scattered in a wide area.
- To achieve success in collecting reliable and dependable information in a short span of time.

## **I. QUESTIONNAIRE DESIGN**

Designing of questionnaire is an art rather than a science. It is an effort of compiling a set of questions by repeatedly checking out for errors, of learning what to avoid and what to include. However a basic design strategy can be developed. The designing of questionnaire generally goes through three phases, i.e, (I) Developing a design strategy (II) Constructing the questionnaire (III) Drafting and refining the questionnaire.

### **Phase I : Developing A Design Strategy**

(1) **Specify the Information Sought.** The researcher should be able to specify the list of information needs. Generally this task has already been accomplished when the research proposal or the research design was developed. The hypothesis stated earlier is the guiding light in stating the information requirement. The hypothesis establishes the relationship between the variables and the researcher can ideally develop the data that is required to be collected to prove or disapprove the hypothesis.

(2) **Determine the Communication Approach.** It refers to the decision on the method used to conduct the survey *i.e.* personal interview, depth interview, telephone, mail, computer etc. This decision on method to be used will have a bearing on the type of questionnaire to be designed. The choice of communication approach is influenced by factors like the location of respondents, the time and funds available, nature of study, etc. The

communication approach chosen results in different introductions, different instructions, layout etc. Once the communication approach has been finalised, a decision is then taken on the type of questionnaire that is to be framed.

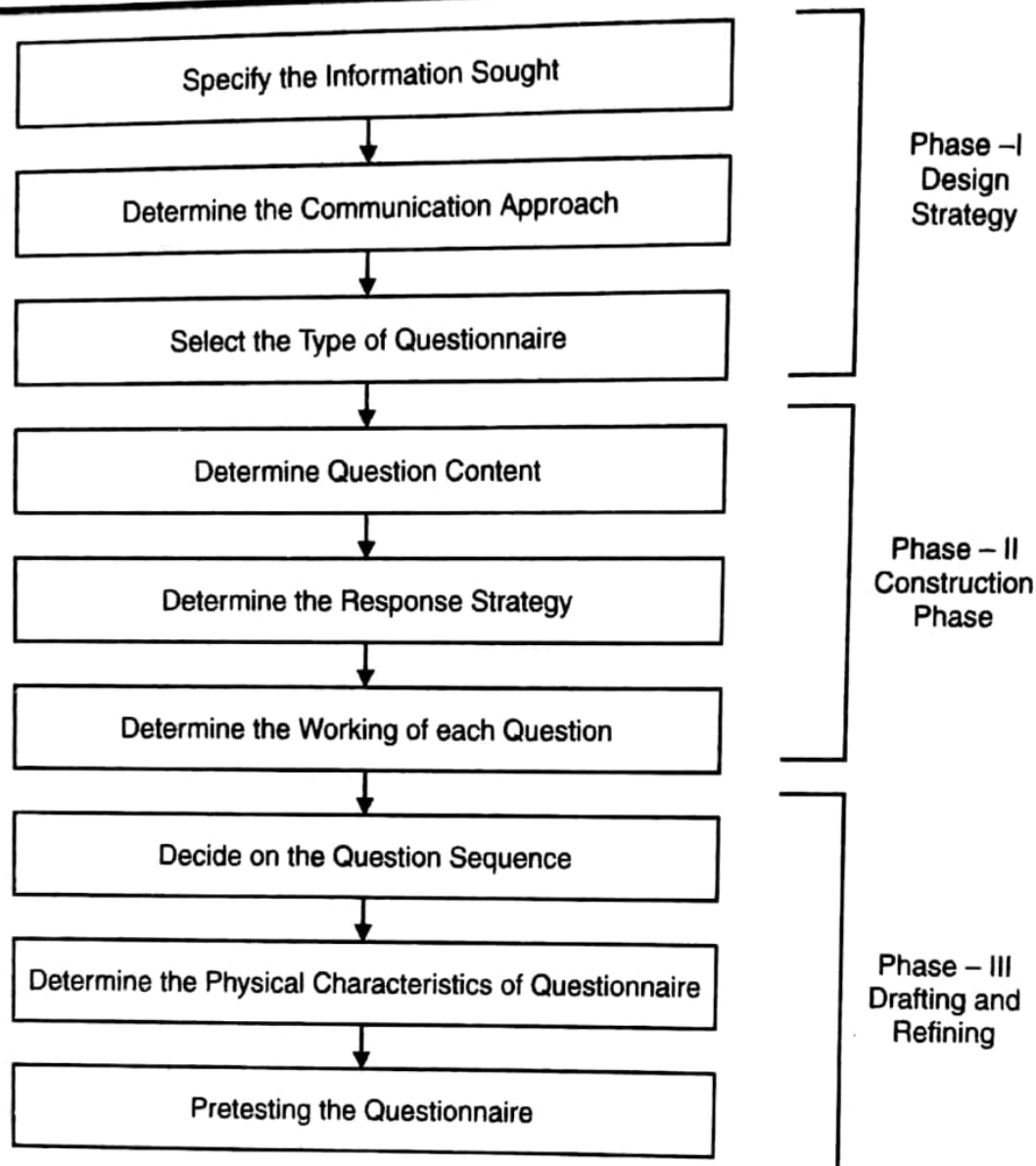


Fig. 8.4 Procedure for Designing A Questionnaire

A questionnaire can be of four types

- (i) Structured—undisguised
- (ii) Unstructured—disguised
- (iii) Unstructured—undisguised
- (iv) Structured—disguised

**(3) Select the Type of Questionnaire.** In this step the researcher specifies how the data will be gathered by stating the type of questionnaire required. The questionnaire can be of four types.

- **Structured—Undisguised Questionnaire.** The most popular type, it involves using questions with clear direct wording, having a logical order. The wording and order remains the same for all the respondents. They are very simple to administer and easy to tabulate.
- **Unstructured—Disguised Questionnaire.** The exact opposite of the earlier type, this questionnaire hides the purpose of research and shows no clear order or tendencies. Such a questionnaire generally uses projective methods (discussed earlier) to collect data. A disguised or hidden stimulus is given to the respondent and the response is in an unstructured form.

- **Unstructured–Undisguised Questionnaire.** In this type of questionnaire the purpose of the study is clear but the questions are generally open ended. *e.g.* “How do you feel about putting a ban on student union election ?” The respondents are free to reply in an unstructured manner. These questionnaires are generally used in depth interviews.

- **Structured–Disguised Questionnaire.** The purpose of this questionnaire is to hide the motive of study but allow for ease in coding and analysis. This approach is based on the fact that direct questions may influence or bias the replies, but if the questions are disguised than we ask the respondents what they know and not what they feel *e.g.* the earlier question will be framed as

What is the effect of student union election ?

- (a) It creates awareness
- (b) It disrupts studies
- (c) .....
- (d) .....

Although such questionnaire offer ease of tabulation and analysis, yet because of the effort involved in framing disguised questions, this is not a every popular method.

## **Phase II. Constructing the Questionnaire**

**(4) Determine Question Content.** This step initiates the task of framing specific questions which would yield the data required for study.

While framing the questions certain things should be kept in mind :

- Is the question necessary ? Every question should have some use in providing additional and genuine information.
- Is the question complete ? The question should have the proper scope to reveal all the information that a researcher needs to know.
- Is a single question or multiple questions required ? There should not be ‘double barreled questions’ which combine two questions in one *e.g.* ‘Are the elections this year transparent and according to election commission guidelines’. This is an incorrect method. Instead to obtain the desired information the following two questions should have been asked :
  - (i) Are the elections this year transparent ?
  - (ii) Where the election commission guidelines adhered to completely.
- Can the respondent articulate ? The respondent may be unable to answer adequately due to his inability to organise his thoughts.

- Is the respondent informed ? The respondent's information level should be kept in mind *i.e.* the content of the question should match the knowledge level of the respondent.
- Can the respondent remember ? The questions should not overtax the respondent's recall ability. No assumption should be made regarding the memory. Take a simple test and answer these questions :
  - (i) What was the last movie you saw ?
  - (ii) Where did you last eat out ?
  - (iii) When did you visit a temple ?

These questions, although very simple, yet test your recall ability.

- Is the respondent willing to answer ? This is of relevance in situation where the questions are sensitive exploring an individual's faith, money matters, family life etc.

**(5) Determine the Response Strategy.** Once the content of questions has been decided upon, the next stage is to decide on the structured response strategy (close response using fixed alternative questions) or an unstructured response strategy (open response using open-ended questions). Some of the response strategies are :

- Dichotomous questions

Do you own a digital camera ?

☐ Yes ☐ No

- Multichotomous questions

Which brand do you prefer for buying digital camera ?

☐ Sony  
☐ Cannon  
☐ Nikon  
☐ Kodak

- Checklist questions

What features do you look for in your digital camera ?

☐ Picture clarity  
☐ Screen size  
☐ Video recording facility  
☐ Economical  
☐ Smart physical looks  
☐ Free service for 1 year  
☐ Large memory capacity

- Scale questions may be of the rating or ranking type

### Ranking

Which of the following media has been instrumental in influencing your choice of digital camera ? Rank them giving 1 to the most effective media, 2 to the next most and so on.

- Television
- Company Brochures
- Newspapers
- Net Advertising
- FM Radio

### Rating

Of the following factors, rate each factor in terms of the 'most desired', 'some what desired' and 'least desired' that four digital camera should possess.

	● Most Desired ●	● Some What Desired ●	● Least Desired ●
1. High Picture Clarity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Large Memory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Big Screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Zooming Function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Picture Editing Function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Small Size	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Video Recording Facility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**(6) Determine the Question's Wording.** This stage is concerned with the phrasing of each question. The researcher needs to use utmost caution in framing the question since a poorly phrased question will either lead to a wrong response or result in refusal to answer.

While wording a question the following things should be kept in mind :-

- Use simple words – The questionnaire is not a test of respondent's vocabulary, hence the words should be simple e.g. 'where, in your opinion, does the forte of this organisation lie ? Since some may not know the meaning of word 'forte', hence it is better if it is phrased simply as 'Where in your opinion, does the strength of this organisation lie ?'
- Avoid technical jargon – Use of technical words may render even the highly educated respondents helpless in answering the questions.
- Avoid using ambiguous questions – words like 'occasionally', 'often', 'sometimes', 'you' etc. are all problem words e.g.

How often do you watch movies in a theatre ?

- ☐ Never
- ☐ Occasionally
- ☐ Sometimes
- ☐ Often

This question is worthless since everybody has a different interpretation of occasionally and sometimes.

- Avoid biased wording- Questions that lead respondent towards an answer, give him a clue to the questions, are biased or leading questions. Such questions should be avoided since they distort the intent of the question *e.g.*
  - (i) 'Do you think government is doing right by allowing FDI in retail sector ?'
  - (ii) 'Do you consider it appropriate to use low cost accessories for your car ?'

These questions force a respondent to think in a particular direction.

- The level of personalization should be controlled *e.g.* 'what should our government do today' ?
  - (a) Increase defence expenditure, even if it means more taxes.

The alternative can also be written as

- (a) Increase defence expenditure even if you have to pay more tax.

The second alternative is more personalised and both these alternatives will produce different results. There is no fixed rule to say which method is to be used. However one should choose that level of personalisation which presents the issue more realistically.

### Phase III. Drafting and Refining the Questionnaire

(7) **Decide On Question Sequence.** From this step, we enter the stage of drafting the questionnaire and the ordering of questions is an important aspect.

The following things need to be kept in mind :-

- Use simple and interesting questions first. It makes the respondent feel comfortable. An alternative is to use 'funnel approach' whereby broad questions are asked first and specific questions are asked later on.
- The questions should be arranged in a logical order. Jumping from topic to topic would break the flow of respondent and he would lose interest in filling the questionnaire.
- Classification questions should be asked later on. Classification questions are the personal questions. The reason for asking classification questions before target questions is to avoid alienating the respondent before getting to the heart of study *e.g.* respondents who readily offer their opinion on preferred car types would most likely balk from responding with same freedom if their income is asked first.
- Difficult and sensitive questions should not be asked right in the beginning of the questionnaire so as to avoid threatening the respondent.



- Branching of questions should be done with care. Branching refers to directing the respondent where to go next in the questionnaire on the basis of his answer to preceding questions. Branching is easier in case of telephone or personal interview schedule but when the questionnaire is to be mailed, branching should be avoided as it may confuse the respondent.

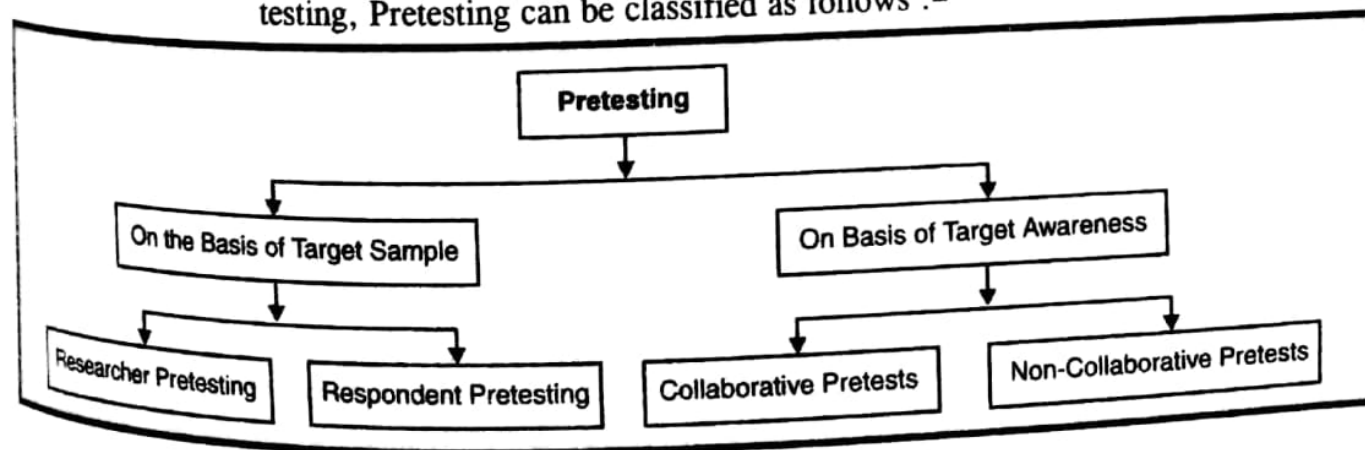
**(8) Determine the Physical Characteristics.** The physical appearance affects the way the respondents react to the questionnaire.

Hence the following points should be observed :

- Use a good quality paper with high definition ink so that it can be read easily. The questionnaire should look professional and easy to answer.
- Size of the questionnaire is important. Smaller questionnaire is preferred to a lengthy one provided the small size is not achieved at the expense of appearance. If a small size is achieved by making the questionnaire crowded then it will lead to errors and result in less informative answers.
- A questionnaire should be accompanied by an introductory letter. It should introduce the study and make the respondent realise the worth of his answers. The importance of research and the importance of respondent's replies should be conveyed through the letter.
- The instructions should be written clearly and politely. The method of reporting the responses *i.e.* tick mark, cross or circle should be stated clearly. If the respondent is to skip certain questions then 'go to' instructions should be used and if an entire section is to be skipped then different colours for different sections should be used.

**(9) Pre-Testing the Questionnaires.** The process of using a questionnaire on a trial basis on a small group of respondents to determine how the questionnaire is performing is termed as pre-testing. Pre-testing helps to find out the errors in individual questions alongwith the sequence of questions. Various aspects like the ability of questionnaire to generate respondent's interest, the interpretation of the meaning of questions, the continuity of the questions, the time required to fill the questionnaire can be tested through pre-testing, Pretesting can be classified as follows :-

The process of using a questionnaire on a trial basis on a small group of respondents to determine how the questionnaire is performing is termed as pre-testing.



- **Researcher Pre-testing.** This involves a small group of fellow researchers testing the instrument in the initial stages of design. These researchers can provide valuable input to improving the questionnaire.
- **Respondent Pre-testing.** In this, pre-testing is done by a small sample drawn from the target respondent population. The instrument in its ready form is administered to the sample and then input can be taken from them on the questionnaire.
- **Collaborative Pre-testing.** When the respondents are told about their role in pre-testing then it becomes a collaborative pre-test. In such a pre-testing detailed probing of each and every question is done and it is usually a time consuming process.
- **Non-Collaborative Pre-test.** When the respondents are not told about their role in pre-testing it becomes non-collaborative pre-test. Since they are not being told, their cooperation will be relatively less comprehensive. However this approach has the advantage that it is conducted in situation exactly similar to the real environment.

After pre-testing the final revised questionnaire is prepared.

## SCHEDULES

Another method of data collection, very similar to the questionnaire, is use of schedules. A schedule is a set of questions which are answered by respondents but filled by the enumerators in their own hand. The schedules are particularly used in interviewing where the interviewer not only asks questions but also fills the answer with his own hand. This method is more expensive since it involves the selection and training of enumerators. This method is used by big organisations or governments who have huge funds at their disposal. *e.g.* population census is conducted using schedules. Although both questionnaire and schedule are a set of questions and the method of preparing is same yet there are significant differences between the two.

A schedule is a set of questions which are answered by the respondents but filled by the enumerators in their own hand.

## OBSERVATION

Observation refers to the monitoring and recording of behavioural and non behavioural activities and conditions in a systematic manner to obtain information about the phenomena of interest.

Observation is a popular method of data collection in behavioural sciences. The power of observation has been summed by W.L. Prosser<sup>7</sup> as follows, "there is still no man that would not accept dog tracks in the mud against the sworn testimony of a hundred eye witnesses that no dog had passed by." Observation refers to the monitoring and recording of behavioural and non behavioural activities and conditions in a systematic manner to obtain information about the phenomena of interest.

## CASE STUDY METHOD

Case study research is used to examine contemporary real life situations and apply the findings of the case to the problem under study.

Case study research is a qualitative research method that is used to examine contemporary real-life situations and apply the findings of the case to the problem under study. Case studies involve a detailed contextual analysis of a limited number of events or conditions and their relationships. It provides the basis for the application of ideas and extension of methods. It helps a researcher to understand a complex issue or object and add strength to what is already known through previous research.

It is often argued that since this method relies on only a small number of cases hence the findings are not subject to generalization. However if the case study establishes the parameters correctly then the findings can be applied to all research. In this way, even a single case could be considered acceptable, provided it met the established objective.

Cases should be selected on the dimensions of a theory or on diversity of a dependent phenomenon.

A researcher should always remember that the success of this method depends largely on the case study chosen for analysis. While using the case study research method, a researcher should observe the cases should be selected on dimensions of a theory (pattern matching) or on diversity of a dependent phenomenon (explanation-building).

## THE EXPERIMENTAL METHOD

The experimental method studies the cause and effect relationship between variables and adopts stringent control methods to conduct research.

The research methods discussed earlier are used frequently however they suffer from a drawback that they exhibit a lack of control over the situation. Most of these methods are not insulated from the effect of the extraneous variables. The experimental method however is one such research method that overcomes this problem and adopts a stringent control method to conduct research. As a result this method is often described as the true scientific method. The experimental method adopts an experimental research design, (The details have been discussed in the chapter on 'Research Design') and studies the cause and effect relationship between the variables. The basic difference between the experimental method of research and the non-experimental method is that the former involves the deliberate manipulation of one variable, while trying to keep all other variables constant.

## SAMPLING DEFINITIONS

In this section, a description of various terms relevant to the concept of sampling has been covered.

**I. Population/Universe.** Population refers to the aggregate of all the units which possess a certain set of characteristics on the basis of which the sample seeks to draw inferences e.g. a study is to be conducted on 'Awareness of AIDS among rural women'. This study is conducted in a village which comprises of 2000 females out of which 35% i.e. 700 belong to 0-18 age group, 45% i.e. 900 belong to 18-50 age group and 20% i.e. 400 belong to 50+ age group. Since our study is on rural women which has been defined as 'females within 18-50 age then the population is said to be of 900 females. Universe refers to the total of all the units in the field of inquiry, which in this case is 2000. Thus all units in any field of inquiry (females) constitute universe and all units from whom information is sought, on the basis of one or more characteristics (females within 18-50 age) e.g., age, constitutes population.

A universe or a population can be finite or infinite. If it is possible to enumerate all the possible units in its totality then it is a finite population or universe. Our earlier example of 2000 females is an example of finite universe.

All units in any field of inquiry constitute universe and all units from whom information is sought constitute population.



The size of a finite population is generally denoted by the symbol 'N'. In certain situation it may not be possible theoretically to enumerate or observe all the items in the field of enquiry. A classic example is the number of stars in the sky. Actually speaking there is hardly any population that is infinite in the real sense, it is just that it is not possible to enumerate all of them in a reasonable span of time. In other words we can say that we use the term 'infinite population' for a very large finite population.

**II. Sampling Frame/Source List.** It is a representation or a list of all the elements of target population from which the sample is to be drawn. This list could be according to some name, number or a set of characteristics. Sampling frame may already be available in a ready form or the researcher may have to construct it. In case the population is finite and the time frame is the present or past then a sampling frame is available which coincides exactly with the population. However in most cases the researcher has to prepare the source list by himself. Examples of readily available sampling frames are the telephone directory, electoral rolls list etc. Thus sampling frame is the operational definition of population that provides the basis for sampling.

**III. Sampling Design.** The blue print for obtaining a sample from the sampling frame is termed as a sampling design. It refers to the techniques used in drawing a sample. A researcher may employ probability or non-probability techniques. Sampling design has been discussed in detail in the next chapter.

## SAMPLING DESIGN PROCESS

The sampling design process is more of an adherence to certain points than a definitive process. It can be summarised in six steps, as shown in Figure 6.1.

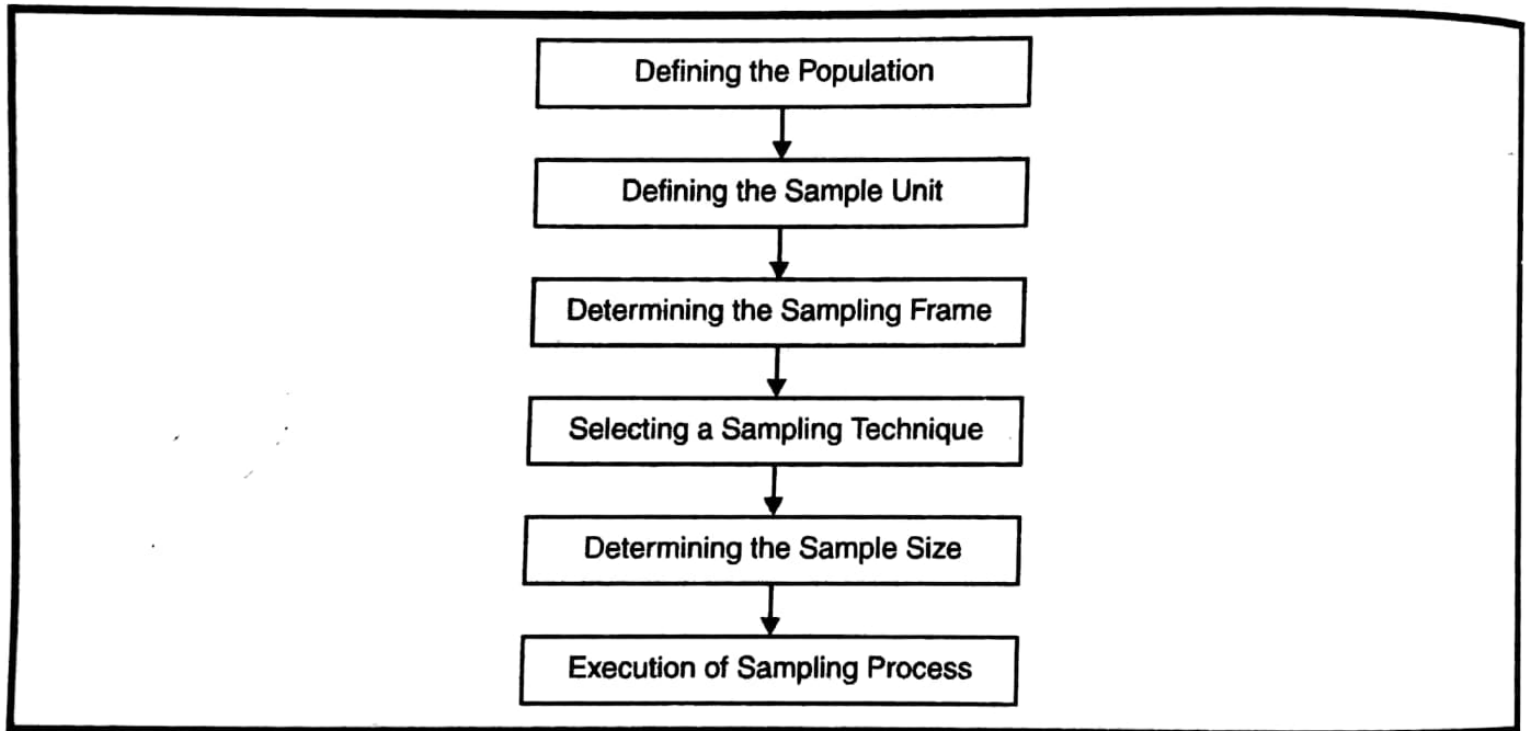


FIG. 6.1 THE SAMPLING DESIGN PROCESS

The steps shown in the diagram flow out of each other and are thus interrelated. The important aspects of each of these steps are discussed in a little more detail.

**I. Defining the Population.** The first step is the most critical step wherein a researcher has to give an operational definition for his relevant population. Population in the most common form implies the total number of individuals in the area of study from whom information is being sought, but depending on the nature of study the population can be events, workplaces etc. As stated earlier, the members who possess the characteristics or information required by the researcher constitute target population.

**II. Defining the Sample Unit.** A corollary to the above point is defining the sample unit. The sampling unit is the person, place or object about which or from which the information is required for research e.g. in case of study conducted on newspaper readership an entire household could be a sampling unit, however, in case of study on brand preference of college students in jeanswear every college going student is a sampling unit.

**III. Determining the Sampling Frame.** Also referred to as 'Source List' it is a comprehensive listing of all the members of a population e.g. a telephone directory is a good sampling frame, as association directory e.g. NASSCOM will have a listing of all the firms in the industry. If the sampling frame is not available, then the researcher needs to prepare the list. It may be possible that the source list does not cover all the elements of population. In that case sampling frame error enters our research which has to be accounted for in further analysis.

**IV. Selecting the Sampling Technique.** The researcher must decide on the type of sample *i.e.* a probability or non-probability based sampling techniques. The decision as regard to the technique to be used is affected by the objectives of study, the level of accuracy desired, time and cost etc. The different sampling techniques available to a researcher are discussed in detail in the next section.

**V. Determining the Sample Size.** The million dollar question that faces the researcher is 'What sample size is needed?' A misconception is that a large sample size is a more representative sample. However there is no rigid rule that is used, although a formula does exist. A sample size is considered optimum if it fulfills the requirements of efficiency, representativeness, reliability and flexibility. Number of subjective factors like nature of population, nature of respondents, time and funds available, sampling technique used etc. influence the decision on sample size.

**IV. Execution of Sampling Process.** The last step involves working out the details of drawing a sample. Procedures for selecting each unit must be worked out. In case of non-response, the procedure to be adopted for filling the vacant unit should be stated clearly.

## TYPES OF SAMPLING TECHNIQUES

Sampling technique or sampling design can be broadly grouped in two distinct categories : probability and non-probability. In probability sampling, all the elements in the population have a known chance or probability of being included in the sample. In non-probability sampling the elements do not have a known or pre-determined chance of being selected as subject. Figure 6.2 makes a comparison of probability and Non probability sampling.

### PROBABILITY SAMPLING

1. Every individual has a known and equal chance of being selected.
2. We refer to both sample as well as population. Sampling frame is used.
3. Paramteric tests are mostly used.
4. A sample is more representative of population characteristics.

### NON-PROBABILITY SAMPLING

1. No probability is associated with an individual being selected
2. Sampling frame is not developed.
3. Non-paramteric tests are preferred.
4. Nothing definite can be said about the representativeness of non probability sample.

FIG. 6.2 : Probability and Non-Probability Sampling

Probability samples are used in studies where the researcher is looking for high degree of representativeness so that generalisations about the sample results can be made. However when other factors like cost, time, convenience become important rather than generalizability, then non-probability sampling is used.

There are two types of sampling techniques : (a) Probability sampling where every object or individual has a known and equal chance of being selected (b) Non-probability sampling which has no probability associated with the selection of an object or individual.

The different sampling designs can be shown using two factors viz; (i) representation basis, which classifies design as probability and non-probability and (ii) on the element selection basis. When an element is drawn individually without any restriction then it is known as a unrestricted sample and when the element is drawn, subject to some conditions then it is termed as a restricted sample. Figure 6.3 shows the different types of sampling designs classified on the basis of these two elements.

Representation Basis Element Selection Technique	PROBABILITY	NON-PROBABILITY
UNRESTRICTED	Simple Random Sampling	Convenience Sampling
RESTRICTED	Complex Probability Sampling <ul style="list-style-type: none"> <li>• Stratified Sampling</li> <li>• Systematic Sampling</li> <li>• Cluster Sampling</li> <li>• Sequential Sampling</li> </ul>	Purposive Sampling <ul style="list-style-type: none"> <li>• Judgement Sampling</li> <li>• Quota Sampling</li> <li>• Snow Ball Sampling</li> </ul>

Fig. 6.3 Different Types of Sampling Designs

## PROBABILITY SAMPLING DESIGNS

### I. Simple Random Sampling

Simple random sampling is one in which each element of the population has an equal and independent chance of selection. It can be drawn using random number tables or lottery method.

A simple random sample is defined as one in which each element of the population has an equal and independent chance of being selected. In case of a population with N units, the probability of choosing n sample units, with all possible combinations of  $N_{C_n}$  samples is given by  $\frac{1}{N_{C_n}}$ . e.g. If we have a population of five elements (A, B,C, D, E) i.e. N = 5, and we want a sample of size n = 3, then there are  $5_{C_3} = 10$  possible samples and the probability of any single unit being a member of the sample is given by  $\frac{1}{10}$ .

Simple random sampling can be done in two different ways i.e. 'with replacement' or 'without replacement'. When the units are selected into a sample successively after replacing the selected unit before the next draw, it is a simple random sample with replacement. If the units selected are not replaced before the next draw, and drawing of successive units are made only from the

remaining units of the population, then it is termed as simple random sample without replacement. Thus in the former method a unit once selected may be repeated, whereas in the latter a unit once selected is not repeated. Due to more statistical efficiency associated with a simple random sample without replacement it is the preferred method.

A simple random sample can be drawn through either of the two procedures i.e. through lottery method or through random number tables.

**(a) Lottery Method.** Under this method units are selected on the basis of random draws. Firstly each member or element of the population is assigned a unique number. In the next step these numbers are written on separate cards which are physically similar in shape, size, colour etc. Then they are placed in a basket and thoroughly mixed. In the last step the slips are taken out randomly without looking at them. The number of slips drawn is equal to the sample size required.

Lottery method suffers from few drawbacks. The process of writing N number of slips is cumbersome and shuffling a large number of slips, where population size is very large, is difficult. Also human bias may enter while choosing the slips. Hence the other alternative i.e. random numbers can be used.

**(b) Random Number Tables.** These consist of columns of numbers which have been randomly prepared. Number of random tables are available e.g. Fisher and Yates Tables, Tippets random number etc. Listed below is a sequence of two digit random numbers from Fisher & Yates<sup>3</sup> table :

61, 44, 65, 22, 01, 67, 76, 23, 57, 58, 54, 11, 33, 86, 07, 26, 75, 76, 64, 22, 19, 35, 74, 49, 86, 58, 69, 52, 27, 34, 91, 25, 34, 67, 76, 73, 27, 16, 53, 18, 19, 69, 32, 52, 38, 72, 38, 64, 81, 79 and 38.

The first step involves assigning a unique number to each member of the population e.g. if the population comprises of 20 people then all individuals are numbered from 01 to 20. If we are to collect a sample of 5 units then referring to the random number tables 5 double digit numbers are chosen. e.g. using the above table the units having the following five numbers will form a sample : 01, 11, 07, 19 and 16. If the sampling is without replacement and a particular random number repeats itself then it will not be taken again and the next number that fits our criteria will be chosen.

Thus a simple random sample can be drawn using either of the two procedures. However in practice, it has been seen that simple random sample involves lots of time and effort and is impractical. Zina O'Leary comments that "Simple random sampling is rarely used in practice because the process demands identification of all the elements of the population, lists of all those elements, and a way of randomly selecting from this list—a tall order" Hence other methods of probability sampling, also called as complex probability sampling, are used.

## II. Stratified Sampling

This method of sampling is used in situation where the population can be



easily divided into groups or strata which are distinctly different from each other, but the elements within a group are homogeneous with respect to some characteristics *e.g.* students of college can be divided into strata on the basis of gender, courses offered, age etc. In this the population is first divided into strata and then a simple random sample is taken from each stratum. Stratified sampling is of two types : proportionate stratified sampling and disproportionate stratified sampling.

**(a) Proportionate Stratified Sampling.** In this the number of units selected from each stratum is proportionate to the share of stratum in the population *e.g.* in a college there are total 2500 students out of which 1500 students are enrolled in graduate courses and 1000 are enrolled in post graduate courses. If a sample of 100 is to be chosen using proportionate stratified sampling then the number of undergraduate students in sample would be 60 and 40 would be post graduate students. Thus the two strata are represented in the same proportion in the sample as is their representation in the population.

This method is most suitable when the purpose of sampling is to estimate the population value of some characteristic and there is no difference in within-stratum variances.

**(b) Disproportionate Stratified Sampling.** When the purpose of study is to compare the differences among strata then it becomes necessary to draw equal units from all strata irrespective of their share in population. Sometimes some strata are more variable with respect to some characteristic than other strata, in such a case a larger number of units may be drawn from the more variable strata. In both the situations the sample drawn is a disproportionate stratified sample.

When the purpose of study is to estimate the population value of some characteristic and there is no difference in within-stratum variances, proportionate stratified sampling is used. When the purpose of study is to compare the differences among strata, disproportionate stratified sampling is used.

### **III. Systematic Sampling**

It is a very versatile and simple form of probability sampling. In this method every  $n^{\text{th}}$  item within a defined population is selected in the sample. It involves beginning with a random start of an element in the range of 1 to  $n$ . The sample ratio vis-a-vis the total number of entries is worked out and after a random start every  $n^{\text{th}}$  item is chosen e.g. every 20th person in the list or every 10th house could be chosen as a part of the sample.

The major advantage of systematic sampling is that there is no need to assign a unique number to each element or use random number tables. It is



statistically more efficient if the population elements have similar characteristics. The systematic sampling suffers from two major drawbacks viz., periodicity and monotonic trend. In case there is 'periodicity' in the population that coincides with the sampling ratio, then the randomness is lost e.g. if systematic sampling is used to generate weekly store sales from a sampling frame containing weekly sales of past two years and the sample interval is 7, then the sample would not reflect the weekly variation in sales. This is because the sample interval coincides with the period of data collection. The second problem arises if there is a 'monotonic trend' in population i.e. the sampling frame has been arranged in some order like a chronological order or from smallest to largest etc. e.g. the population of India's software industry comprises of 3000 companies which have been arranged from the smallest to largest order and a sample of 100 is drawn with a sample interval of 15. Let the draw start randomly from a company listed on number 12. Then drawing every 15<sup>th</sup> company would exclude the top or largest companies from the sample.

#### IV. Cluster Sampling

In cluster sampling, groups of elements that ideally speaking, are heterogeneous in nature within group, are chosen randomly. Unlike stratified sampling where groups are homogeneous and few elements are randomly chosen from each group, in cluster sampling the group with intra group heterogeneity are developed and all the elements within the group become a part of the sample. Whereas stratified sampling has intra group homogeneity and inter group heterogeneity, cluster sampling has intra group heterogeneity e.g. a committee comprising of number of members from different departments has a high degree of heterogeneity. When from number of such committees, few are chosen randomly, then it is a case of cluster sampling.

This is an example of one stage cluster sampling. If from each cluster which has been randomly chosen, few elements are chosen randomly using simple random sampling or any other probability method then it is a two stage cluster sampling. A cluster sample can be a multiple stage sampling, when the choice of element in a sample involves selection at multiple stages e.g. if in a national survey on insurance products a sample of insurance companies is to be drawn, then it requires developing clusters at multiple stages. In the first stage the clusters are formed on the basis of public and private companies. At the next stage a group of companies is chosen randomly from each cluster developed earlier. In the third stage the office location of each chosen company from where data is to be collected is chosen randomly. Thus in multistage sampling, probability sampling of primary units is done, then from each primary unit a sample of secondary sampling units is drawn and then the third level, till we reach the final stage of breakdown for the sample units.

#### V. Area Sampling

A variant of cluster sampling is area sampling. In area sampling, groups or

clusters are formed on geographic basis such as sectors, blocks etc. In this a particular block is chosen randomly and then all the units or households within the block are included in the sample. This is a single stage area sampling. Cluster sampling or area sampling is particularly suitable when sampling frame does not include every member of the population, but lists of clusters or geographical areas are available. However, a major drawback is that the clusters are rarely heterogeneous e.g. houses within a block are more similar than dissimilar.

## **VI. Sequential Sampling**

A complex form of sampling, it involves drawing samples in a sequence, but data collection and analysis is done at each stage. The size of the sample is not fixed in advance but a decision rule is stated before the sampling begins. At each stage after analysis has been done, the decision rule is checked to see if further sampling is to be continued or not, e.g. a sample of consumers is drawn to study their proclivity for domestic or foreign brands in AC's. In this the sampling is continued till the time sufficient data is collected to establish their preference.

# NON PROBABILITY SAMPLING

## I. Convenience Sampling

convenience sampling  
e researcher has the  
edom of choosing any  
spondent based on his  
venience.

The most common type of non probability sampling done without any restrictions is convenience sampling. In this the researcher has the freedom of choosing any respondent based on his convenience. Respondents become a part of the sample because they happen to be at the right place and at the right time, e.g. in surveys conducted at a retail outlet or shopping mall interviews, people who happen to be at these places at the time the response was being taken become a part of the sample. Convenience sampling is an economical method and is generally used in exploratory phase of a research project. The sampling units are cooperative, easily accessible and reachable. However convenience sampling suffers from many drawbacks like bias, less precision and lack of proper representation of the population.

## II. Judgement Sampling

udgement Sampling is a  
urposive sampling where  
ose respondents are  
eliberately made a part of  
ample, which meet  
search purpose based on  
searcher's own  
dgement.

It is a kind of purposive sampling where those respondents are deliberately made a part of a sample, by virtue of their position, knowledge or any other criteria, which meet research purpose. In this case the researcher uses his own judgement or expertise to decide who would be a part of the sample e.g. if a survey is being conducted on finding out what it takes to be a student union leader, then it is the people who are in this position i.e. student union leaders, or those who frequently interact with such people, who can give first hand information. This method is particularly suitable when only a limited number of people have access to the knowledge or information required for research. This sampling does not allow for generalizability to a specific population since it does not represent a population explicitly.

## III. Quota Sampling

uota sampling, group  
created which are  
ogenous within and a  
is fixed for each  
.

This method is used when a researcher needs certain group to be adequately represented. In this groups are created which are homogeneous with respect to certain characteristics within group. A quota is fixed for each group and sample units are drawn from the group. The quota sampling is similar to stratified sampling except for the fact that no sampling frame is used and sample units are drawn on convenience basis instead of random basis. The researcher while drawing the sample, using this method, tries to ensure that the composition of sample is the same as the composition of population with respect to the characteristics of interest. It is also possible to assign quotas to a group which is greater than the proportion of that group in the population e.g. while studying consumer behaviour it may be desirable to oversample heavy users of a product so that their behaviour can be studied in detail. Quota sampling tries to make the sample representative at a low cost.

## IV. Snow Ball Sampling

In this a set of respondents are selected initially and interviewed. After

In snow ball sampling a set of respondents are selected initially and interviewed and they further recommend the names of other people.

this, these respondents are asked to list the names of other people who in their opinion are a part of the target population. Thus it is like setting the ball in motion whereby referrals are obtained from referrals, thus creating a snow ball effect which keeps on growing in size as it rolls down. It has been seen that people referred by the respondents have greater demographic and psychographic characteristics similar to them than they would occur by chance. This technique has the advantage of locating right people with the desired characteristics at a low cost.

**Advantages:** Some advantages of simple random sampling are:

- (1) All elements in the population have an equal chance of being selected.
- (2) Of all the probability sampling techniques, simple random sampling is the easiest to apply.
- (3) It is the most simple type of probability sampling to understand.
- (4) It does not require a prior knowledge of the true composition of the population.
- (5) The amount of sampling error<sup>3</sup> associated with any sample drawn can easily be computed.

**Disadvantages:** The simple random sampling techniques suffers from certain drawbacks.

- (1) It is often impractical, because of non-availability of population list, or of difficulty in enumerating the population. For example, it is difficult to get a current accurate list of households in a city or a list of landless rural agricultural labourers who migrate from area to area in search of employment or a list of households of a nomadic tribe.
  - (2) The use of simple random sampling may be wasteful because we fail to use all of the known information about the population.
  - (3) This technique does not ensure proportionate representation to various groups constituting the population. ✓
-

#### PROBLEMS OF RANDOM SAMPLING

- (4) The sampling error in this sampling is greater than that in other probability samples of the same size, because it is less precise than other methods.
- (5) The size of the sample required to ensure its representativeness is usually larger under this type of sampling than under other random sampling techniques.
- (6) A simple random design may be expensive in time and money.

These problems have led to the development of alternative superior random sampling designs like stratified random sampling, systematic sampling, etc.

iciency is

**Advantages:** The principal advantages of proportionate stratified sampling are:

- (1) It enhances the representativeness of the sample by giving proper representation to all sub-groups in the population.
- (2) It gives higher statistical efficiency than that given by simple random sampling for a given sample size.
- (3) It is easy to carry out this sample method.
- (4) This method gives a self-weighting sample, the population mean can be estimated simply by calculating the sample mean.

**Disadvantages:** The drawbacks of the proportionate stratified random sampling are:

- (1) A prior knowledge of the composition of the population and the distribution of the population characteristics are required to adopt this method.
- (2) This method is very expensive in time and money. Of course its greater efficiency may offset the additional cost.
- (3) The identification of the strata might lead to classification errors. Some elements may be included into the wrong strata. This may vitiate the interpretation of survey results.



**Advantages:** The major advantages of disproportionate sampling are:

- (1) It is less time consuming compared with proportionate sampling, because the researcher is not necessarily concerned about the proportionate representativeness of his resulting sample as in the latter method.
- (2) It facilitates giving appropriate weighing to particular groups, which are small but more important.

**Disadvantages:** The disadvantages of disproportionate sampling are:

- (1) This method does not give each stratum proportionate representation. Hence, the resulting sample may be less representative.
  - (2) This method requires a prior knowledge of the composition of the population, which is not always possible.
  - (3) This method is also subject to classification errors. It is possible that the researcher may misclassify certain elements.
-

**Advantages:** The major advantages of systematic sampling are:

- (1) It is much simpler than random sampling. It is easy to use.
- (2) It is easy to instruct the field investigators to use this method.
- (3) This method may require less time. A researcher operating on a limited time schedule will prefer this method.
- (4) This method is cheaper than simple random sampling.

- (5) It is easier to check whether every 'k'th has been included in the sample.
- (6) Sample is spread evenly over the population.
- (7) It is statistically more efficient than a simple random sample when population elements are ordered chronologically, by size, class, etc. Then systematic sampling gives a better representative sample.

**Disadvantages:** The primary disadvantages of systematic sampling are:

- (1) This method ignores all elements between two 'k'th elements selected. Further, except the first element, other selected elements are not chosen at random. Hence, this sampling cannot be considered to be a probability sampling in the strict sense of the term.
- (2) As each element does not have an equal chance of being selected, the resulting sample is not a random one. For studies aiming at estimations or generalizations, this disadvantage would be a serious one.
- (3) This method may sometimes give a biased sample. If by chance, several 'k'th elements chosen represent a particular group, that group would be over-represented in the sample.