UNIT II

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What is research design?

Research design is a logical and systematic plan to conduct a research study.

- research design specifies the objectives of the study and the methodology and techniques to be adopted to achieve the objectives
- it is a plan deciding the types and sources of data
- It is a program specifying the methods of collecting, analyzing and interpreting the observations and data.
- It decides the allocation of resource and time frame.

In a nutshell, research design constitutes the blue print of the research study similar to the blue print of a building detailing all the relevant details.

A research design must answer the following questions unequivocably :

- what is the study about?
- why is the study undertaken?
- where will be the study carried out?
- what type of data is required?
- where can the data be found?
- when to conduct the study?
- what will be the sampling design?
- what techniques are to be used in collecting data?
- how will the data be analysed?
- what should be the style of report?

Some of the practical questions to be answered by research design.

- How information is collected in a survey? Is it through making questionnaire, telephonic interview, internet or personal interview?
- Should collection of data be supported by observation?
- Which one to follow, cross-sectional research or longitudinal survey, that is, to collect data at one time or at regular intervals?
- Should the questionnaires/interview be structured or unstructured?
- Should the questions in the interview schedule be open-ended or closed?
- How to achieve reliability and validity?
- Should interviewers be trained prior to collection of data?
- Are data to be collected through census or sampling? If through sample, what type of sampling technique to be employed?

Components of research design

Research design has four important components :

(i) *Sampling design*: This deals with how a sample is selected (the question of sampling does not arise in studies based on census *i.e.* collecting data from all the units of a population) It involves selection of an appropriate sampling technique. The various sampling techniques are discussed in the Chapter 'Sampling'

(ii) *Data Collection Design*: Data are collected through a number of means such as observation, interview or questionnaire. The design specifies the appropriate method of data collection. This component is discussed in the chapter 'Data Collection'.

(iii) *Statistical Design*: Data collected are subjected to statistical analysis for proper interpretation. This component deals with the statistical technique suitable for the particular type of data. The techniques generally employed are detailed in the Chapter 'Statistical Analysis' (Tests of significance).

(iv) *Report Design*: This component decides how the results or the research study as a whole are presented to the target audience. Type of report and the style of presentation of research report are outlined in the Chapter 'Report Writing'

Need for research design:

A well-planned research design goes a long way in helping the researcher carry out his/her study efficiently and effectively.

The purpose of the research design is :

- to facilitate smooth running of the operations
- to gain maximum information with minimum expenditure of efforts, time and money.
- to provide anchorage for the study from straying aimlessly
- to select appropriate methods /techniques to collect/analyse the data keeping in view the objectives of the study and availability of personnel, time and money
- to help the researcher in organizing his/her ideas to look for flaws /inadequacies/ limitations.

Types of research design

Research designs are classified into various types based the nature of the study and treatment given. The factors which influence the classification are:

(i) The degree to which the objectives are clear (In a formal research such as descriptive and experimental research the objectives are clear, whereas in an exploratory or formulative research the objectives are hazy)

(ii) The method of data collection (data may be collected through observations resulting in an observational study or through interviews resulting in a communication –based study)

(iii) The ability of the researcher to interfere (in action research or experimental research the researcher manipulates the independent variables or the causative factors; in other studies the researcher cannot interfere and report / analyse as it is)

(iv) The purpose of the study (in a descriptive study the researcher just describes the various parameters of a population and answer 'what', 'when', 'where' and 'which' but in a diagnostic/analytical study the researcher strives to answer the question 'why' and explain the relationship, if any, and reasons out why a particular phenomenon is occurring)

(v) Time dimension (to complete the study in a short time as in the case of a time-bound cross-sectional observation or to study the problem over an extended period as in a longitudinal study)

(vi) The depth of the study (in a case study, the subject as a whole is studied in depth, whereas in a statistical study only a sample is studied)

(vii) The research environment (depending on the location and method, a study could be a historical study, a laboratory study, simulation study or a field study).

Due to overlapping or similarity of some of the above mentioned determinants, the research designs are categorized into five general types *viz. exploratory design, descriptive design, diagnostic (analytical) design, causal research design and experimental design*. Some authors bring the diagnostic / analytical design under descriptive design. Observation study, communication-based study, cross-

sectional or longitudinal study, case study, historical study, etc. are only different variants of descriptive design.

Exploratory design

It is an unstructured design to gain familiarity with an unknown population or phenomenon. It seeks only general information to test the possibility of conducting a detailed research. It is similar to testing the water before one takes a plunge.

The purpose of an exploratory design is :

- to generate new ideas
- to familiarize the researcher with the problem
- to make a precise formulation of the problem (formulation of hypotheses)
- to gather background information for clarifying a concept
- to decide whether a particular study is feasible or not
- to clarify and define the nature of a problem
- to screen alternatives.
- to expand the understanding of management dilemma.
- to identify information that should be gathered to formulate investigative questions and
- to find our sources for and actual sample frames that might be used in sampling design.

This design does not aim at testing hypotheses. In fact, exploratory design is used to fine-tune the hypotheses to be tested in a formal research. It just attempts to see what is there in store for the researcher. No steps are taken either for a thorough description or for seeking association of variables.

Exploratory designs are particularly useful when researchers lack a clear idea of the problem. It helps researchers develop concepts more clearly, establish priorities, develop operational definitions and improve the final research design. It saves time and money. The possibility of continuing a research project in other areas may be decided with the help of an exploratory design.

The sampling technique employed is non-probability sampling techniques such as convenience or judgmental sampling.

Examples:

- Space scientists exploring the possibility of existence of living organisms in other planets

- Zoologists/ecologists observing the behaviour of wild animals at close quarters in African jungles for 'Animal Planet' channel
- A marketing researcher feeling the pulse of rural population to explore the possibility of large scale retailing of micro-oven or computers
- An ad agency exploring the idea of figuring physically-challenged persons in electronic media to popularize personal health-care products
- A mobile restaurant introducing exotic cuisines for 'budget' consumers
- A personnel manager introducing 'performance-based variable pay structure' in one of the divisions to feel the reaction of the employees to the new system of compensation.
- A management's trial to select managers based on emotional intelligence rather than work experience to improve interpersonal relationship
- A BPO company's attempt to improve the efficiency through 'virtual office'.

Sources of exploratory studies:

Interaction with people, day-to-day happenings, freak incidents etc. may help a vigilant researcher select topics for exploratory studies. The following are some of the common resources:

- *Literature survey*:

  Going through periodicals, reports, surveys and etc. gives leads and clues to exploratory research.

- *Experience survey*:

  An exploratory research technique in which individuals who are knowledgeable about a particular research problem are surveyed.

Informal interviews with persons having experience will help researchers securing insights into the subject and related facts. People who might provide information include:

i. Newcomers to the scene such as the employees recently transferred / promoted
ii. Workers in isolated posts
iii. Antagonistic workers or the workers in the most unproductive sections
iv. Executives who do not fit well in the organization
v. Employees who represent varied interests

- *Secondary data analysis*: It is preliminary review of data collected for another purpose to clarify issues in the early stages of a research effort.
- *Analysis of insight-stimulating cases:*

In an unexplored area of study, an intense probe into a few selected cases may yield stimulating insights.

- Indepth interviewing using conversational method rather than structured interview
- Participant-observation to have a first hand perception of the participants
- Capturing the life of group under study through films, videotapes, photographs and etc for detailed observation.
- Employing Projective Techniques and Psychological tests (Thematic Apperception Test, Games, Role-plays and etc)
- Street ethnography to understand how a group behaves at the street level
- Elite interviewing with influential and well-informed people.
- Usage of proxemics and kinesics to study space and body motion communication

- *Pilot Study:* It is any small scale exploratory research project that uses sampling but does not apply rigorous standards. The major categories of pilot studies include focus groups interviews, projective techniques and depth interviews.

Focus group interview: It is an unstructured free flowing interview with a small group of people. A focus group is a panel of individuals led by a trained moderator. The moderator or facilitator uses principles of group dynamics to focus or guide the group in an exchange of ideas, feelings and experiences on a specific topic. The facilitator introduces the topic and encourages the group to discuss it among them without any inhibition. Typically the group consists of 6 to 10 members. Further details are discussed in chapter 8.

Projective techniques: Projective technique is an that enables a person to 'project' beliefs and feelings onto a third person, an object or a situation.

Depth interview: It is relatively unstructured, extensive interview employed in the primary stages of a research process.

Exploratory vs. Formal designs:

The essential differences between exploratory and formal designs are the degree of structure and the immediate objective of the study. While exploratory designs tend to have loose structures with the immediate objective of developing hypothesis or questions for further research, formal designs involve precise procedures and specific data source with a goal of testing hypothesis or answering the research questions.

In contrast to exploratory studies formal studies are structured with clearly stated hypotheses or investigative questions. Formal research studies try to answer a variety of objectives:

- Descriptions of phenomena or characteristics associated with populations
- Estimates of proportions of populations
- Discovery of associations among different variables
- Establishing cause-and-effect relationships among variables, if any.

Descriptive Design:

As the name suggests descriptive design describes an organization, industry, people, situation, phenomenon and etc. It covers size, distribution, proportions and etc. of populations. Tangibles as well as intangibles are described. Employees' opinion / attitude on management, interpersonal relationship, performance appraisal, training and development programmes and etc. come under descriptive design. An in-depth investigation/description of an individual/organization over a period of time results in a case study.

- Descriptive design is more specific than exploratory design as it focuses on specific aspects/ dimensions of the problem
- Descriptive design aims at identifying the various characteristics of a community, an institution or a problem.
- It is used in fact-finding investigation to gather detailed information about a population or phenomenon
- The data are presented as ranges, means, percentages or proportions
- Descriptive design may be simple or complex
- The objective of a descriptive design is to answer the questions 'who', 'what', 'when', 'which' or 'where' of the problem
- Collection of data through descriptive design is a pre-requisite for diagnostic/analytical design
- The simplest descriptive study is concerned with hypotheses to state something about the size, form, distribution or existence of a variable

The population can be studied or described by census or sampling. If the population is small and manageable, census (collecting data from each and every unit of the population) is appropriate. In the case of a large population a representative sample is taken for the study.

Example:

- To study the market share of a company's product or services vis-à-vis that of the competitors to devise a strategic plan for further expansion.

- To describe the dealers' network of a company in respect of their size, turnover, products, infrastructure facilities, workforce and etc for effective management of company-dealers relationship

Diagnostic Design:

While descriptive design is solely concerned with 'what is existing / happening?' diagnostic design throws light to answer the question 'why is it existing/happening?' Some authors consider diagnostic design as a part of descriptive design. But in many cases, the researchers are more particular about answering the 'why' part of a problem.

- Diagnostic design tries to find out the relationships, if any, among the various variables, dimensions or parameters.
- It aims at identifying the causes of a problem to enable the researcher search for a solution
- It helps in testing of hypotheses

Examples:

- To study to reasons for the low/high market share of a particular product/service
- To find out why the dealers' interest in a particular product/company is on the decline.
- To understand why the consumers behave in a particular way towards a particular service/product

The differences among the various research designs are shown in table

Component	**Type of Design**	
	Exploratory /Formulative	**Descriptive / Diagnostic**
Sampling design	Only non-probability	Probability or non-probability depending on nature of the population
Observational design	Unstructured instruments to collect data	Structured instruments
Statistical Design	No pre-planned design	Pre-planned design

Operational Design	No fixed procedure	Advance decision on procedures
Overall Design	Flexible	Rigid

Table - Exploratory / Formulative Design vs. Descriptive / Diagnostic Design

Analytical Design

This design is a part of diagnostic design. It is presumed that analysis is a pre-requisite for diagnosis. In medical profession, the physician subjects the patient to a number of tests (analyses) such as measurement of blood pressure, blood/urine sugar, hemoglobin, cholesterol and etc. for diagnosis of the ailment. Similarly, a researcher in the field of finance analyses various financial ratios (liquidity ratios, leverage ratios, activity ratios, profitability ratios and growth ratios) to diagnose the reasons as to why a particular company's financial performance is exemplary or poor. Generally research problems related to finance are brought under analytical design.

Examples

- To compare the financial performances of firms in an organization and to seek reasons for the variance
- To analyse the working capital management and its impact on revenues/profit

Causal Research Method

Known as explanatory research, causal research method is a design to identify cause-and-effect relationships among variables. Normally, exploratory and descriptive studies precede cause-and-effect relationship studies.

- Causal studies try to explain predictive relationships such as a prediction about the influence of price, packaging, advertising etc on sales.
- In causal research the researcher must have a thorough knowledge of the subject to interpret relationship.

Causal research involves the following:

- Establishing the appropriate causal order or sequence of events.

- Measuring the concomitant variations between the presumed cause and the presumed effect.

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Experimental Design

Experiment is a research method in which conditions are controlled so that one or more variables can be manipulated to test a hypothesis. *Experimentation* is a research method that enables evaluation of causal relationships among variables.

In ex-post facto / descriptive study the researcher interviews respondents and observes what is happening or what has happened. Diagnostic/analytical study has the potential of discovering association. In these studies the researcher accepts the world as it is found. He /she cannot manipulate. But in experimental study, the experimenter is able to alter the variables of interest and observe the after-effect. Experiments are studies involving intervention by the experimenter beyond that required for measurement. The usual type of intervention is to manipulate the setting/situation through independent variables.

In experimental study there are three basic requirements:

First, there must be at least one independent variable and a dependent variable.

Secondly, beyond the relationship of independent and dependent variables, time order of the occurrence of the variables is important. That is, the dependent variable should not precede the independent variable, but they can occur almost simultaneously.

Thirdly, the experimenter must be sure that other extraneous factors do not influence the dependent variable.

Examples

- A physician administering different medicines on groups of patients to find out the most curative medicine
- An agricultural scientist applying various types of fertilizers in the field to choose the best fertilizer for improvement of yield of a crop

Advantages and disadvantage of experiments:

Advantages of experimentation

- Experimentation is a sort of primary data collection to establish causality between variables which is possible due to the researcher's ability to manipulate the independent variables.

- Contamination from extraneous variables can be controlled more effectively in experimentation than in other designs. This helps in isolating experimental variables and evaluating their impact.

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Disadvantages of experimentation

- Laboratory conditions are perceived as artificial.
- Generalization from non probability samples can pose problems despite random assignment.

Case study method

A case study is an in-depth and thorough study of an organization, a group of people, an industry, an individual or a phenomenon. It is a sort of descriptive design. When reasons are sought for the happenings it becomes a descriptive-cum-diagnostic design.

- Case study describes the peculiarities of a case
- It probes uncommon, unique, extreme or even typical cases whose features are not studies by usual methods
- It provides a wealth of information for intensive analysis of specific details
- It examines the complex factors to understand the causative variables
- It is a long-term process

SAMPLING TECHNIQUES

After deciding what research design is to be adopted, the next step is collection of data. The need for adequate and reliable data in any study is of paramount importance. There are two ways to collect the required information or data. ***viz*** census and sampling.

Census vs Sampling

Census method: It is also known as complete enumeration survey method, Under this method, data are collected from each and every unit of the population or universe (student, household, college, shop, customer, firm and etc). Population or Universe is the complete set of items which are of interest to the researcher/study. The most popular example is the population census

undertaken by Govt of India periodically. Here, information / data are collected from each and every household.

Advantages of census method:

- Information can be collected from each and every unit of the population when individual data are the essence of the study. Examples are recruitment of personnel, preparation of voters' list or income tax assessment of individuals.
- The results of a complete enumeration are expected to be more accurate than sample method

Disadvantages:

- Census need not necessarily provide accurate information as evidenced by the experience of a number of enumerators. The errors in a complete enumeration survey arise mainly from incomplete coverage and inadequate observation due to the difficulties encountered in organizing a survey on a large scale and lack of sufficient number of trained personnel to conduct the survey.
- The effort, money and time required for carrying out complete enumeration will be, generally, extremely large or prohibitive.
- When the units of population get damaged or distorted while testing or collecting data, census cannot be adopted. For instance, when the organizer of a party orders for cakes and desires to check the quality of cakes he cannot adopt a census method as he cannot afford to taste each and every cake. In this case sampling is the alternative. This method, where the units get damaged while testing, is known as destructive sampling.

Sampling method:

In the sampling method instead of every unit of the population, only a part of the population is studied and conclusions are based on the data/information collected from that part of the population.

Principles of sampling

There are two important principles which govern the theory of sampling.

(i) *Principle of statistical regularity:* This principle is based on the mathematical theory of probability. The law of statistical regularity states that 'a moderately large number of items chosen at random from a large group, are almost sure on the average to possess the characteristics of the large group'. This principle points out that if a sample is taken at random from a population it is likely to possess almost the same characteristics as that of the population. This principle emphasises the need for choosing sample at random.

(ii) *Principle of 'Inertia of large numbers'*: It states that, other things being equal, larger the size of the sample, more accurate the results are likely to be. This points out to the fact that conclusion drawn based on a larger sample is more reliable than that of a smaller sample.

Terms used in sampling

Population: A population is the total collection of elements/units about which some inferences are drawn. It is also known as universes. All the cancer-patients in a city for medical research, all the mango trees in an orchard for a horticultural research, all the customers of a store for a CRM study, all the students in a class for a teaching method study, all the bolts/nuts manufactured for a quality control research or all the rice grains in a bag are examples of populations. That is population refers not only to people but all items that have been chosen for study.

Finite population: If the number of elements/units in a population is limited and accessible to the researcher for data collection, it is known as a finite population (car manufacturers in a country, exclusive dealers of a popular brand of white goods, students in a class, employees in an organization or the exporting units in SEZ)

Infinite population: If the researcher has no definite idea of the total number of units of a population and accessibility to all the units is not easy for data collection it is an infinite population (TV viewers, bicycle owners, black money launderers, drug addicts, cell-phone users in a city, income tax evaders, customers of a departmental store or consumers of pizza)

Target population: It is part of the total population about which the study is concentrated (users of a particular network among the mobile phone owners, students with commerce degree among the MBA students, computer-savvy employees in an organization or post-graduates among the call-centre employees).

Element/Unit: It is a member of the population and the subject on which information is collected or measurement is made.

Subject: It is a single member of a sample as element in population.

Census: It is the study or collection of information/data from all the units/elements of a population.

Sample: A sample is the portion of the population which is supposed to truly represent the population. Some of the cancer-patients in the medical research, few of the mango trees in an orchard for the horticultural research, a group of customers of a store in the CRM study, a section of the students in a class in the teaching method study, a small number of bolts/nuts in the quality control research or a handful of rice grains from a bagful of rice constitute a sample.

Representative Sample: Representative sample contains the relevant characteristics of the population *in the same proportions* as they are included in that population.

Sampling: It is the process of selection of a sample (a part of the population) with a view to obtain information or draw inference about a population.

Sampling Unit: It is the element or set of elements that is available for selection in some stage of sampling process (such as cities, households and individuals in a multistage sampling.

Sampling Technique/Design: It is the procedure adopted to select a sample (probability or non-probability)

Sampling frame: It is a list containing all sampling units from which the sample is to be drawn. In finding out the satisfaction level of customers of BSNL in Coimbatore, the Coimbatore Telephone Directory is the sampling frame. In studying the performance level of a particular brand of car the list of buyers maintained by the dealer is the sampling frame. For the study on income tax payers, the list of IT payers maintained at It office is the sampling frame.

Sampling fraction: It is expressed as n/N where 'n' is the sample size and 'N' is the population size.

Estimator: Any sample statistic that is used to estimate a population parameter is called an estimator. That is, an estimator is a sample statistic used to estimate a population parameter. Example: The sample mean $\bar{x}$ can be a an estimator of the population mean μ.

Estimate: An estimate is a specific numerical value of the estimator. That is, an estimate is a specific observed value of a statistic.

Parameters vs. Statistics: A parameter is a characteristic of a population, whereas a statistic is a characteristic of a sample.[table 6.1]

Parameters are characteristics which describe a population. Statistics are characteristics which describe a sample. Mean, Variance, S.D. and etc are the characteristics to describe a population or sample.

Characteristics	**Symbols**	
	Population Parameters	**Sample Statistics**
Size (No. of units)	N	n
Mean	μ	$\bar{x}$
Variance	σ^2	s^2
Standard Deviation	σ	s

Table: Parameters vs Statistics

Need for sample / Sampling:

- Sampling reduces the time and cost of research. Study of small portion of the population (sample) is certainly cost-effective and saves time
- Sampling saves labour. The man-power requirement to collect data/ information from a sample is always less than that of a population.
- Sampling improves quality of research. As more attention/concentration can be bestowed on a sample, supervision and processing of data would be better then that of census. In census, the researcher may lose the focus due to tiredness and boredom of collecting data from a large volume of units.
- Sampling provides quick results. Studying a sample consisting of a fewer units is quicker than studying more units in a population.
- Sampling is the only way out in certain situations. When the units get damaged while testing (finding the breaking strength of pencils or tasting of rasagollas) only sampling helps to know about the population. And also when the population is infinite (TV viewers, drug addicts or pizza eaters) sampling is the only course.

Limitations of sample/sampling

- Sampling must be carefully planned and executed. It demands a thorough knowledge of sampling methods; otherwise the results obtained may be inaccurate or misleading
- When the population is heterogeneous or the characteristic to be measured occurs rarely in the population, a large sample is required. A large sample has all the drawbacks of a census.
- A complicated sampling technique may require more labour and the services of experts.

Sampling vs Census: The advantages of sampling over census studies are less compelling when population is small and the variability within the population is high. That is when the population is small or heterogeneous census will be better than sampling.

Characteristics of a good sampling design

A good sampling design must

- Yield a truly representative sample
- Result in a small sampling error
- Be viable when funds are limited
- Control systematic bias in a better ay
- Be applicable universally with reasonable level of confidence.
- Be accurate: Accuracy is the degree to which bias is absent from the sample.
- Be precise: Precision indicates how closely the sample represents the population

A good sampling design helps in collecting a sample which is representative of the population, accurate, precise and of appropriate size.

Sampling designs: (Sampling techniques or sampling methods)

The different types or methods of sampling are governed by two factors *viz.* basis of representation and technique of selection of the units.[Table 6.2]

Basis of representation: The sample may be a probability sample or a non-probability sample. In probability or random sample each unit of the population has an equal chance to get in to the sample. In probability sample the units getting in to the sample depend on chance factor or judgement of the researcher.

Technique of selection of units: The sampling may be either unrestricted or restricted. When the samples are drawn from the entire population without any segmentation it is unrestricted sampling. When the population is segmented into different segments and the sample consists of units from the different segments it is restricted sampling.

The various sampling methods are shown in the following table:

Selection method of units	**Basis of representation**	
	Probability sampling	**Non-probability sampling**
Unrestricted	Simple random sampling	Convenience or haphazard sampling
Restricted	Complex random sampling	Purposive or deliberate sampling

	- systematic sampling - stratified sampling - cluster sampling (area sampling) - multistage sampling - multiphase, double or sequential sampling	- judgement or expert sampling - modal instance sampling - quota sampling - snowballing sampling - self-selection sampling

Table: Sampling methods

Probability Sampling:

The various types of probability sampling techniques are simple random, systematic, stratified, cluster, multistage and multiphase sampling techniques.

(i) Simple random sampling:

This refers to the sampling technique in which each and every item of the population is given an equal chance of being included in the sample. The selection is thus free from personal bias as the investigator does not exercise his discretion of preference. If the sample is chosen at random and the size of the sample is sufficiently large it will represent all the units in the population. That is why, random sampling is sometimes refered to as 'representative sampling'.

The term 'random' in random sampling should not be mistaken for the literal meaning 'without definite aim, direction, rule or method'.

Methods of obtaining simple random samples:

Any of the following methods may be adopted depending on the size of the population.

A. *Lottery method:*

This is a popular method when the population is of manageable size. Under this method all the units/elements/items of the population are numbered or named on separate slips of paper of identical size, colour and shape. These slips are folded and mixed up thoroughly in a container. From this a blind-fold selection is made of the number of slips required to constitute the desired size of the sample.

Here also there are two alternatives:

a. *Sampling with replacement (Equal probability):* After drawing one slip, the name or number is noted and the slip is put back into the container. The process is continued till the desired size is selected. If the same slip reappears, it is ignored and put back. This procedure guarantees each unit the same probability of getting included in the sample.
b. *Sampling without replacement (Varying probability):* In this procedure, the drawn unit is not put back into the container. Here, the probability is not uniform.

Though sampling with replacement appears to be a little difficult, it is ideal compared to the sampling without replacement.

B. *Using table of random numbers:* When the size of the population is large lottery method is cumbersome. The convenient method is using table of random numbers such as Tippett's table of random numbers, Fisher and Yates numbers or Kendall and Balington Smith given in any standard book on statistics.

C. *Using computer:* As an alternative to random numbers, now using computer to printout desired number of random numbers has become popular. State lotteries generally employ computers to select the lucky winners.

In both table of random numbers and computer there is the possibility of some random numbers turning up more than once. Since information from an employee needs to be collected only once, if the same random number appears again it is ignored.

Suitability of simple random sampling:

This sampling technique is suitable when the units/items in a population are almost uniform. When the population is heterogeneous, there are chances that only a particular group may get into the sample and the observation/data from this particular group cannot represent the entire population. For instance, when the student-researcher selects a sample of 100 respondents from among 1000 employees comprising 300 unskilled workers, 300 skilled workers, 200 diploma-technicians and 200 engineer-technicians, there is a probability that only the unskilled workers may get into the sample. The opinion expressed or data collected from the unskilled workers cannot adequately represent the entire population of the employees. When the population is finite but heterogeneous, stratified sampling is more effective.

Merits:

- All the elements/items of the population have equal chances of being included in the sample.
- It is simple to adopt and understand.
- The quantum of sampling error can easily be computed.

Limitations:

- It is often impractical, because of non- availability of population list or difficult in enumerating the population.
- It does not ensure proportionate representation to various groups constituting the population.
- It takes more time and money.

ii.) Complex probability sampling

To overcome the limitations of simple random sampling alternative probability sampling approaches are suggested by researchers.

a.)Systematic sampling:

As in the case of simple random sampling, this method is used in those cases where a complete list of the population is available. This method involves selection of every **k**th item from the list where **k** refers to the sampling interval or skip interval. **k** is calculated by dividing the size of the population

(N) with sample size (n). The starting point or the 1st item between the first and **k**th item is selected at random.

Merits:

- It is more convenient to adopt than random or stratified sampling technique.
- Time and work involved are smaller

Limitations:

- It ignores all the elements between the two **k**th elements. Further, except the first element the rest of the elements is not chosen at random. In strict sense, this method cannot be considered as complete random sampling.

b.)Stratified sampling:

Simple random or systematic sampling procedure will be effective when the population is homogenous, that is, when the units of population are uniform. When the population is not homogenous, but finite, then stratified sampling is more effective. For instance, if a researcher desires to take a sample of 100 respondents from the employees of an organization comprising 150 engineering graduates, 200 diploma holders, 300 skilled workers and 350 unskilled workers, there are possibilities that the entire sample of 100 units may come from only engineering graduates or only diploma holders or only skilled workers when simple random sampling method is used. If this is so, then the sample will not represent the entire population. In a heterogeneous population when each group wants to get represented stratified sampling is more appropriate.

c.) Cluster sampling:

Simple random sampling or stratified random sampling method is used when the population is concentrated in a smaller area and easily accessible as in the case of an organization or a small market place. But when the units/elements of a population are scattered over a larger area and accessibility is expensive and time consuming cluster sampling is more appropriate.

In this technique the units of population are divided into a number of groups or clusters and each cluster will be considered as a sample unit.

Limitations:

- The cluster sizes may vary resulting in a biased sample.
- The sampling error is greater; thus it is statistically less efficient than other probability sampling methods.
- Adjacent clusters of study (eg villages in one state) tend to have more similarity than clusters distantly apart. This influences the 'representativeness' of the sample.

The major differences between cluster sampling and stratified sampling are presented in Table 6.3.

Cluster Sampling	**Stratified Sampling**
- The sampling unit is a cluster i.e., a sub group of population units - The population is divided into many clusters or sub-groups - Clusters tend to be homogenous and within the cluster the units may be heterogenous - Clusters are selected using random sampling technique and the selected clusters are studied in depth - Sampling error may be more	- The population unit itself is the sampling unit - The population is divided into a few sub-groups or strata based on certain criteria - Strata tend to be heterogeneous and within each stratum the units may be uniform - Elements with the strata are chosen based on random sampling method - Sampling error may be less

Table: Differences between cluster and stratified sampling.

Area sampling:

In large field surveys, clusters of geographical areas like districts, taluks or villages are selected by random sampling. As geographical areas are chosen as sampling units the method of sampling is called area sampling. It is not a separate method of sampling but forms a part of cluster sampling.

d.) Multi-Stage Sampling:

As the name suggests this method refers to a sampling method which is carried out in several stages. The population is regarded as made up of a number of first stage sampling units, each of which is made of a number of second stage units and so on. At first, the first stage units are sampled by random sampling. Then a sample of second stage units is selected from each of the selected first stage units again by random sampling. Further stages may be added as required.

e.) Multiphase Sampling

Also known as *double sampling* and *sequential sampling*, it is usually found with stratified and/or cluster designs. Here a sample is drawn to collect some information which is convenient or economical. Based on the information a subsample is taken for further study.

6.8.2. Non- Probability Sampling:

The term *non-probability-sampling* is essentially a common term to include all forms of sampling that are not conducted according to the rules of probability sampling. In fact, the practice of surveying one individual per organization (HR or senior manager) to find out about the organization comes under non-probability sampling. The common non-probability sampling techniques include convenience, purposive, snowball and self-selection sampling methods.

(i) Convenience Sampling:

A convenience sample is one that is simply available to the researcher by virtue of its accessibility.

It is also known as incidental or haphazard sampling. Some experts call it a chunk. A chunk is a fraction of population taken for investigation because of its convenient availability. Here, the sample is selected neither by probability nor by judgement but by convenience. Researchers or field workers have the freedom to choose whomever or whatever they find and thus the name “convenience”.

Advantages:

- It is the cheapest and simplest method
- It does not require the list of population
- No statistical expertise is needed
- It can be used in exploratory studies to gather ideas (opinions)

Limitations:

- Its results are generally biased and unsatisfactory.
- Researchers' subjectivity influences sample collection
- It can hardly be representative of the population
- There is no way of estimating the representativeness of the sample
- The findings cannot be generalized
- It is the least reliable sampling method

(ii) Purposive sampling (Deliberate sampling)

a.) Judgement sampling: It is also known as expert sampling. In this method the population units getting into the sample depend exclusively on the judgement of the researcher. Sometimes the researcher can take the opinion of experts in the field. In other words, the researcher exercises his judgement in the choice of sample units and includes those units in the sample which they think are most typical of the population with regard to the characteristics under investigation.

b.) Modal Instance Sampling

In statistics, the *mode* is the most frequently occurring value in distribution. On the same line, modal instance sampling involves selecting the most frequent case or the typical case. For example, many informal public opinion polls interview typical voters. The major limitation is the difficulty to identify what is a typical case.

c.) Quota Sampling

Quota sampling is intensively used in commercial research such as market research and political opinion polling. The aim of quota sampling is to get a sample that represents a population in terms of the

relative proportions of people in different categories such as gender, age group, occupation, socio-economic groups, ethnicity, and region of residence and in combination of these categories.

Snowball Sampling

It is a technique of 'building up' a list or a sample of a special population by using an initial set of sample units or members as indicators/informants.

For example, a researcher wants to study the challenges of life being experienced by Indians in Gulf countries. It is assumed that the researcher does not have the list or the locations of the respondents. What he does is, in the first instance he contacts one or two respondents through his neighbors, relatives or acquaintances. These initial respondents may give the names/locations of a few other Indians in the Gulf. This process continues till the researcher is able to attain a desired size of the sample.

Self-selection Sampling

This sampling method occurs when the researcher allows each case, usually individuals, to identify their desire to take part in the research. That is, the respondents contact on their own interest. In this sampling technique the researcher publicizes his need for data/information in appropriate medium (print or electronic) and collect data from those who respond.

The differences between probability sampling and non-probability sampling techniques are given in table

Probability sampling	Non-probability sampling
Technically superior	Technically inferior
Sampling bias is eliminated or reduced	There is sampling bias
Sample represents the population	Sample may or may not represent the population
Error range in sampling can be estimated	Error range is difficult to estimate
The probability of selecting population elements in known	The probability of selecting population elements is unknown

Selection procedure to get sample is fixed	There are many ways to choose persons/cases to include in the sample
Population units getting into the sample are not known initially	Field workers or the researchers choose the units.

Table: Probability vs Non-probability sampling

MEASUREMENT AND SCALING

After deciding the type of sampling technique as well as sample size but before heading for collection of information / data, it is necessary to have a practical knowledge on measurement and scaling technique which will be useful in selection of appropriate tool for data collection.

In management science, particularly in marketing and HR, the investigator or researcher encounters various social and psychological variables. The measurement of these variables is inevitable. Further, measurement of psychological variables is not an easy task.

Measurement

Measurement is defined as assignment of numerals to objects / events according to rules or to represent amounts or degrees of a property possessed by all of the objects.

The definition implies that measurement involves:

- selecting observable empirical events.
- developing a set of mapping rules *ie* a scheme for assigning numbers / symbols to represent aspects of the events being measured and

In a research process it is to be noted that it is the properties of objects which are measured and not the objects themselves. Abstract properties like intelligence, attitude, motivation and etc cannot be measured directly. Inference is drawn based on the presumed indicants (indicators) of properties. For instance, the intelligence of a child cannot be measured directly. Only the score in

an intelligent test will indicate whether the child is intelligent or not. Similarly employee satisfaction cannot be measured directly.

Levels of Measurement

Based on the combination of the above three characteristics *viz.* order, distance and origin or absence of any of these characteristics, four levels of measurement are identified.[Table 7.1]

Levels	Characteristics	Utility
Nominal	No order, distance or origin	Determination of equality
Ordinal	Order but no distance or origin	Determination of less than or more than value
Interval	Both order and distance but no origin	Determination of equality of intervals / differences
Ratio	Order, distance and origin	Determination of equality of ratios

Table: Levels of Measurement

(i). Nominal measurement:

It is a scale in which the numbers or letters assigned to objects serve as labels for identification or classification.

- It is the simplest and lowest level of measurement
- It includes the classification of variables into several subclasses by assigning numerals or any other symbols to mutually exclusive sub classes. For example, gender is classified into male and female and the numeral 1 may be assigned to male and 2 to female. In the case of religion, Hindus may be assigned the numeral 1, Muslims 2, Christians 3, Sikhs 4, Jains 5 and others 6. Here, the numerals 1, 2, 3 etc are just labels and have no quantitative value.

(ii). Ordinal measurement

It is a scale that arranges objects or alternatives according to their magnitudes.

- In this measurement, objects/persons are placed in order by assigning ranks in ascending or descending order as 1^{st}, 2^{nd}, 3^{rd} and etc..
- The numbers indicate only rank order. They neither indicate that the intervals between them are equal nor absolute quantities. The real difference between ranks 1 and 2 may be more or less than the difference between ranks 2 and 3. For instance the student in plus 2 exam getting the highest mark, say 1175 out of 1200 is ranked 1^{st}. The next highest mark 1174 gets 2^{nd} rank. The 3^{rd} highest (1170) gets 3^{rd} rank. But the difference between 1^{st} and 2^{nd} rank (1175 and 1174 marks) is not equal to the difference between 2^{nd} and 3^{rd} rank (1174 and 1170 marks)

(iii). Interval measurement

It is a scale that arranges objects or alternatives according to their magnitudes and also differentiates this ordered arrangement in units of equal interval.

- In addition to the features of nominal and ordinal levels, interval measurement has the concept of equality of interval.
- But the numbers on an interval scale cannot be multiplied or divided because the scale does not have a true zero; it has only an arbitrary zero.

(iv). Ratio Measurement:

It is a scale having absolute rather than relative quantities and possessing an absolute zero.

- This is the highest and most ideal level of measurement. Foot-scale is the typical example. Those properties which have natural or absolute zero, such as weight, height, distance, area, money value, population, rate of return and etc can be measured. As there is absolute zero all arithmetic operations *viz.* addition, division, multiplication and subtraction are possible.
- Apart from the statistical tools that can be used at nominal, ordinal and interval levels, geometric and harmonic means and co-efficient of variation can also be used in ratio measurement.

Selection of an appropriate scale:

Selection of an appropriate scale requires decisions in six key areas:

(i) *Study objective (Research objectives):* A scale may be designed to (a) measure the characteristics of the respondents who complete it or (b) use respondents as judges of the objects or stimuli presented to them. For example, we may present students with a scale on the college's various extracurricular activities to obtain their opinion. If the respondents themselves are interested in the extra-curricular activities we may combine each student's answers to form an indicator about the activities. Here the emphasis is on measuring differences in opinion among the students. In the second case, the same data are used to find out the opinion of the students on the various extracurricular activities.

(ii) *Response Scales:* Response scales may be rating, ranking, categorization, sorting and choice technique.

(a) *Rating scales* are used when respondents give scores on object/attitude without making a direct comparison to another object or attitude. For example, the students as respondents may be asked to rate a particular teaching method on a 5 point scale *i.e.* quite effective, effective, average, ineffective and quite ineffective.

(b) *Ranking scales* are used to make comparisons among two or more objects. For example, the respondents may be asked to select which car 'Swift' or 'Santro Zing' has more attractive styling. They may be asked to rank or order the importance of comfort, ergonomics, price, maintenance cost, pickup and mileage.

(c) Categorization asks respondents to put themselves on property indicants in groups or categories.[eg extrovert or introvert, religious or non-religious etc]

(d) Sorting requires the participants sort cards [representing concepts or constructs] into piles suing criteria established by the researcher. The cards might contain photos. images or verbal statements.

(e) Choice technique: It is a measurement task that identifies preferences by requiring respondents to choose between two or more alternatives.

(iii). Degree of preference: In preference measurement the respondents are asked to choose the object or solution each prefers. In non-preference evaluation, the respondents are asked to judge an object without any personal preference toward objects or solutions.

(iv). Scale or data properties: Scaling approaches are viewed in terms of the properties possessed by each scale (nominal, ordinal, interval or ratio)

(v). Number of dimensions:

(a) one-dimensional scale: In this scale the researcher seeks to measure only one attribute of the respondent or object. *(e.g)* employee potential as promotability.

(b) Multidimensional scale: Here, the object is better described with many dimensions rather than one.*(e.g)* Instead of measuring potential just with a simple dimension, promotability, it can be expressed by three distinct dimensions *viz.* managerial performance, technical performance and team work.

(vi). Scale construction: Scales may by classified by the methods to build them. There are five approaches to design a scale *viz.* arbitrary, consensus, time analysis, cumulative and factor scale.

Response methods in scaling

To measure concepts, attitudes or opinions questioning is a widely used method. When a manager is asked his views on a particular employee, the response could be 'a good worker', 'a troublemaker', 'a union activist', 'reliable', 'a fast worker' or 'always a latecomer'. But this type of response is of limited value to the researcher. To improve the usefulness of such replies quantification is necessary. To quantify dimensions that are essentially qualitative rating scales or ranking sales are used.

Rating scales:

- Rating scales are used to judge properties of objects without reference to other similar objects.
- The ratings may be 'like-dislike', 'good - average-bad', 'always – often –sometimes - rarely' or 'strongly agree – agree - no idea - disagree or strongly disagree'.
- There is no conclusive support for choosing a three-point scale over scales with five or more points. The most widely used scales range from three to seven points.

(a) Simple category scale: This scale has two response choices. The choices could be 'yes' or 'no', 'important' or 'unimportant', 'agree' or 'disagree' and etc.

(b) Category scale: It is an attitude scale consisting of several response categories to provide the respondent with alternative ratings. Example: How often is your manager friendly? very often – often – sometims – rarely – never .

Some of the category scale of the category scales are :

Quality: Excellent – Good – Fair – Poor.

Importance: Very Important – Fairly important – Neutral – Not so important – Not at all important

Satisfaction: Very satisfied – Satisfied – Somewhat Satisfied – Not at all satisfied .

(c) Multiple choices – Single response scale: This scale is appropriate when there are multiple options available for the respondent and only one answer is sought.

(e.g). "which magazine do you read often for business news?" Tick (√) any one

Business India	Business Today	Business Week
Business World	Business Standard	Other (Specify)

Similar to simple category scale, this also produces only nominal data.

(d) Multiple choice – multiple response scale: As a variation of the above scale, this scale allows the respondent to select one or several alternatives. *(e.g).* Check any of the following books you consulted to prepare for Organizational Behaviour examination.

O.B. By Fred Luthans

O.B. By Kieth Davis

O.B. By Stephen.P.Robbins

O.B. By McShane

O.B. By L M Prasad

Other (Specify).

It is possible that the six sources would have been consulted. This presents a problem for reporting when the readers expect the responses to add up to 100%. This scale also produces only nominal data.

(e) Likert Scale: It is a measure of attitudes designed to allow respondents to indicate how strongly that agree or disagree with carefully constructed statements that range from very positive to very negative.

(e.g.) "Assignment is the best way of measuring management students' potential"

Strongly Agree	Agree	No Idea	Disagree	Strongly Agree
5	4	3	2	1

In the above example, the respondent chooses one of the five levels of agreement. The numbers indicate the value to be assigned to each possible answer with 1 the least favorable opinion and 5, the most favorable opinion.

(f) Semantic differential scale: It is an attitude measure consisting of a series of seven-point bipolar rating scales allowing responses to a concept. This scale measures the psychological meanings of an attitude. It is used for brand image, organization image, political issues and etc. It is based on the proposition that an object can have several dimensions of connotative meaning which are

located in a multidimensional property space called *semantic* space. The scale consists of a set of bipolar ratings, usually with seven points.

(e.g). The semantic differential scale items for analyzing candidates for leadership position are shown below:

Successful	3	2	1	0	-1	- 2	-3	Unsuccessful
Progressive	3	2	1	0	-1	-2	-3	Regressive
Strong	3	2	1	0	-1	-2	-3	Weak
Active	3	2	1	0	-1	-2	-3	passive
Fast	3	2	1	0	-1	-2	-3	Slow
True	3	2	1	0	-1	-2	-3	False
Sociable	3	2	1	0	-1	-2	-3	Unsociable

Advantages

(g) Numerical Scales: This scale is similar to semantic differential scale except that it uses numbers instead of verbal descriptions as response options to identify response positions. They have equal intervals. The extreme points are labeled by verbal anchors. Numeric scales are often 5-point scales.

(e.g). Performance appraisal can be done on a Numerical scale.

Extremely Favorable	5	4	3	2	1	Extremely Unfavorable

A number of favorable statements like co-operation as team members, knowledge of task, planning effectiveness, ability to attend to minute details, presentation and etc are included and the panelists are to indicate their numbers for each component. The scale provides both an obsolute measure of importance and a relative measure (ranking) of the various items rated.

(h) Multiple rating lists: It is similar to numerical scale, but differs in two aspects; one, it accepts a circled response from the respondent and second the layout allows visualization of the results.

e.g. To find out the relative importance of the various characteristics of the after-sales service of a two-wheeler manufacturer the scale could be as follows:

"Please indicate how important or unimportant each service characteristic is"

Fast and reliable repair	Important	7	6	5	4	3	2	1	Unimportant
Service at customers' place	Important	7	6	5	4	3	2	1	Unimportant
Knowledge and skill of technicians	Important	7	6	5	4	3	2	1	Unimportant

Genuineness of spares	Important	7	6	5	4	3	2	1	Unimportant
Repair charges	Important	7	6	5	4	3	2	1	Unimportant

(i) Fixed or Constant Sum Scale: It is a measure of attitude in which respondents are asked to divide a constant sum to indicate the relative importance of attitude. This scale helps the researcher to find out proportions. The proportions of different categories must sum up to 100. Though up to 10 categories can be used, the precision and patience of the respondents suffer when too many categories are proportioned and summed. The scale is used to record attitudes, behaviour and behavioural intent.

e.g. Preference given to various dimensions of a product (body spray) by a respondent

Price	Brand	Size	Smell	Shape	Total
30%	15%	15%	30%	10%	100%

(j) Staple Scale: This scale places a single adjective in the center of an even number of numerical values. It is used as an alternative to Semantic, Differential Scale when it is difficult to find desired bipolar adjectives.

e.g. To find out the corporate image, five attributes may be used and the opinion on these attributes may be obtained on staple scale as follows:

+5	+5	+5	+5	+5
+4	+4	+4	+4	+4
+3	+3	+3	+3	+3
+2	+2	+2	+2	+2
+1	+1	+1	+1	+1
Customer Friendly	Technology Leader	Exciting products	World Class reputation	Socially Responsible
-1	-1	-1	-1	-1
-2	-2	-2	-2	-2
-3	-3	-3	-3	-3
-4	-4	-4	-4	-4

-5 -5 -5 -5 -5

(k) Graphic Rating Scale:

This scale consists of a graphic continuum that allows respondents to rate an object by choosing any point on the continuum.

Example of graphic scale stressing visual communication. How was the lunch?

Excellent ---------- Very Poor.

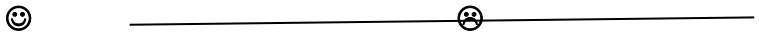
- It was created to enable researchers to find out the fine differences in the attitude/opinion of respondent
- Theoretically an infinite number of ratings is possible as there is no fixed interval

(e.g.) "How likely are you to recommend your College/Institute to others seeking admission for MBA programs?"

Very Likely I----------I Very Unlikely

Putting an 'X' at any position along the line reflects the respondent's suggestion.

Example of graphic scale stressing visual communication. "How was the lunch?" The response is indicated by putting an 'X' along the line.



Problems of Rating Scales:

Successful measurement using rating scales depends on the assumption that a respondent is able to make good jugements. But the respondents tend to make errors and the most common errors are leniency, central tendency and halo effect.

Leniency: The error of leniency occurs when a respondent is either an 'easy rater' or a 'hard rater'. The raters are inclined to give higher score when they know the respondents well and where the acquaintances are lower the scores will be less.

Central tendency: When the raters are reluctant to give extreme judgment, scores will be near the centre of the scale resulting in the error known as central tendency.

Halo effect: It is a systematic bias the rater introduces by carrying a generalized impression from one rating to another. For instance, when an examiner of answer scripts is impressed with the answer to the first question, he/she carries the impression that the subsequent answers are also good resulting in the student scoring better grades even though the other answers are not as good as first question's answer.

Ranking scales:

In ranking scales, the respondent directly compares two or more objects and makes choices among them.

a. Simple ranking: Respondents often rank order their preferences from most preferred to least preferred. It is not difficult for respondents to understand the task of rank ordering the importance of things such as fringe benefits, social security measures, financial incentives etc. The problem is when the no. of items increases, ranking is different.

b. Paired-comparison scale: In this scale the respondent can express attitudes/opinions unambiguously by choosing between two objects. The number of judgements required in paired comparison is n(n-1) / 2 where 'n' is the number of objects or stimuli.

c. Forced Ranking Scale: In this scale the respondents are asked to rank the attributes / objects relative to each other. For instance, if the marketing researcher desires to know which attribute is to be given preference to a new car model he may ask the consumers to rank the attributes such as price, safety, style, colour, mileage, size and etc relative to each other attribute.

d. Comparative Scale: In this scale the respondents are required to compare the items/objects/stimuli against a standard. It is ideal for comparisons of programmes, processes, brands, points of sale, people and etc, if the respondents are familiar with the standard. Suppose the Principal of a college wants to compare his college with others he may ask the PG students to compare with their previous college the ambience of the present college as superior –same– inferior.

Scale Construction Techniques:

In social science studies as well as in many of management research projects the opinions or attitudes of the respondents are obtained using questionnaire, opinionnaire or inventory. This approach uses a number of questions/statements relevant to the topic and the respondents are required to express their agreement or disagreement. The statements / questions are formulated in such a way that they are able to elicit responses which are psychologically related to the attitude being measured and discriminate not only the extremes of attitude but also among individuals who differ slightly.

Inferring attitude from the recorded responses has several limitations :

- Respondents may conceal their attitude and express socially acceptable attitudes / opinions
- They may not really know how they feel about the issue under investigation
- They may not be aware of their attitude about an abstract situation.

i. *Arbitrary Scales:* These scales are developed on ad hoc basis. The designs of the scales largely depend on the researcher's own subjective selection of items.
   - The researcher collects several items / dimensions which are believed to be unambiguous and appropriate to a given topic
   - Some of the items are selected and included in the instrument.

Illustration: Assume that the researcher is interested in studying the image of a company compared to other companies. The researcher may decide to consider a few dimensions *viz.* place of work, social responsibility, compensation, equal opportunity employer and innovation to assess the image of the company. A 5-point scale may be constructed taking into consideration the relevant dimensions.

As a place to work	Bad	-	-	-	-	-	Good
As a socially responsible Co.	Bad	-	-	-	-	-	Good
As an ideal compensator	Bad	-	-	-	-	-	Good
As an equal opportunity employer	Bad	-	-	-	-	-	Good
As an innovating company	Bad	-	-	-	-	-	Good

The respondents are required to score each of the items from 1 to 5 depending on the degree of favorableness

The results are studied in several ways :

- Totals may be made by individual items, by company or by companies as places to work, as socially responsible company and etc.
- Totals for each company or for individual respondents are calculated to determine how they compare.

Advantages:

- Easy to develop, inexpensive and can be designed to be highly specific.
- They provide useful information and are adequate if developed skillfully.

Limitations:

- The approach is subjective
- The researcher's insight and ability offer the only assurance that the items chosen are representative of the universe of content
- There is no evidence that the respondents will view all the items with the same frame of reference.

ii. Consensus scaling: In this technique the items to be included in the questionnaire are selected by a panel of judges. The judges evaluate the items based on relevance to the topic, potential for ambiguity and level of the attitude they represent.

A popular consensus scale is Thurstone equal appearing interval scale.

(Thurstone Scale).

Developing Thurstone Scale:

- A large number of statements, usually around 100, are written on cards expressing various views toward the object, institution or idea under study.
- There is only one statement per card
- The cards are submitted to a panel of judges (more than 50)
- Each of the judges arranges the statements in 11 piles or groups ranging from one extreme opinion / attitude to another in position.(from favourable to unfavourable)
- In case of marked disagreement among the judges in assigning a position to an item, that item is discarded
- Pile Number 1 is labelled " Most Favourable", pile no. 6 "Neutral " and pile No. 11 " Most Unfavourable".
- The 8 intermediate piles are unlabelled to create the impression of equal – appearing intervals between the 3 labeled positions

iii. Item Analysis: It is a procedure for evaluating an object, group, institution and etc. based on how well it discriminates between those persons whose total score is high and those whose total score is low. The most popular scale using item analsis is the summated or popularly known Likert Scale.

Advantages of Likert Scale:

- It is easy and quick to construct
- Each item that is included has met an empirical test for discriminating ability
- Since respondents answer each item it is more reliable and provides a greater volume of data than other scales.

iv. Cumulative Scales:

An important scale of cumulative scales is Scalogram. Scalogram analysis is a procedure to determine whether a set of items forms a one-dimensional scale. A scale is unidimensional if the responses fall into a pattern in which agreeing of the item reflecting the extreme position results also in agreeing to all items that are less extreme.

v. Factor Scales: (Semantic Differential Scale and Multidimensional scaling)

Factor scales are developed through factor analysis or on the basis of inter-correlations of items which indicate that a common factor accounts for the relationship between items. Two important scales based on factor analysis are Semantic Differential Scale and Multidimensional Scaling.

a. Semantic differential scale: Developed by Charles E. Osgood *et al*. S.D. scale is an attempt to measure the psychological meanings of an object to an individual. They produced a long list of

adjective pairs useful for attitude research. According to them three factors contributed most to meaningful judgements by respondents *viz.* evaluation, potency and activity.

Steps in S.D. Scale construction :

- Selection of concepts: The concepts are nouns, noun phrases, or visual sketches chosen by personal judgement.
- Selection of scale (at least three scales)
- Panel of judges is used to rate the various stimuli (or objects) on the various selected scales and the responses of all judges would then be combined to determine the composite scaling.

Example: S.D. Scale for analyzing candidates for an industry leadership position.

1.Sociable	3	2	1	0	-1	-2	-3	Unsociable
2.Strong	3	2	1	0	-1	-2	-3	Weak
3.Active	3	2	1	0	-1	-2	-3	Passive
4.Progressive	3	2	1	0	-1	-2	-3	Regressive
5.Tenacious	3	2	1	0	-1	-2	-3	Yielding
6.Fast	3	2	1	0	-1	-2	-3	Slow
7.True	3	2	1	0	-1	-2	-3	False
8.Heavy	3	2	1	0	-1	-2	-3	Light
9.Hot	3	2	1	0	-1	-2	-3	Cold
10.Successful	3	2	1	0	-1	-2	-3	Successful

Items 1, 4, 7 and 10 indicate ‘evaluation’, items 2, 5 and 8 ‘Potency’ and items 3, 6 and 9

‘Activity’ dimensions.

7.2 Unidimensional and Multidimensional Scales

Scaling may also be classified as unidimensional, two-dimensional, three-dimensional and multi-dimensional (Trochim,2008)

Unidimensional: Concepts like height, weight, thirst or self-esteem are unidimensional because they can be measured with a single dimension (line). The line is shorter or taller in the case of height, less thirst and more thirsty in the case of thirst or less or more in the case of self-esteem.

Shorter ⟵ Height ⟶ Taller.

Less Thirsty ⟵ Thirsty ⟶ More thirsty

Less ⟵ Self –esteem ⟶ more

Fig 7.2: Example of unidimensional scaling

Two- dimensional: In the case of intelligence, there are two dimensions viz., mathematical ability and and verbal ability to measure intelligence. If a concept like intelligence is truly two – dimensional, (mathematical and verbal) it is not possible to depict a person's intelligence using only a single number line. That is, to describe intelligence, it is necessary to locate a person as a point in two-dimensional space. (x = verbal, y = mathematical space)

Three – dimensional scale:

Any objects can be distinguished or differentiated from each other along three dimensions viz., activity evaluation and potency as in semantic differential scale.

Multi – dimensional scale [MDS]: It is also known as perceptual mapping. This technique is commonly used to identify the product attributes that are important to the customers. It is also employed to measure the product's relative importance.