

## RESEARCH:

A CAREFUL INVESTIGATION/ENQUIRY ESPECIALLY TO SEARCH FOR NEW FACTS IN ANY BRANCH OF KNOWLEDGE.

(OR)

A SYSTEMATIC METHODOLOGY WHICH CONSISTS OF

- STATING THE PROBLEM CLEARLY AND EXACTLY
- FRAMING A HYPOTHESIS
- COLLECTING THE REQUIRED DATA
- ANALYZING FACTS OBSERVED AND COLLECTED
- ARRIVING AT CONCLUSION APPROPRIATELY

(OR)

ACCORDING TO THE AMERICAN SOCIOLOGIST EARL ROBERT BABBIE, "RESEARCH IS A SYSTEMATIC INQUIRY TO DESCRIBE, EXPLAIN, PREDICT, AND CONTROL THE OBSERVED PHENOMENON.

RESEARCH IS CONDUCTED WITH A PURPOSE TO:

- IDENTIFY POTENTIAL AND NEW CUSTOMERS
- UNDERSTAND EXISTING CUSTOMERS
- SET PRAGMATIC GOALS
- DEVELOP PRODUCTIVE MARKET STRATEGIES
- ADDRESS BUSINESS CHALLENGES
- PUT TOGETHER A BUSINESS EXPANSION PLAN
- IDENTIFY NEW BUSINESS OPPORTUNITIES

## CHARACTERISTICS:

1. GOOD RESEARCH FOLLOWS A SYSTEMATIC APPROACH TO CAPTURE ACCURATE DATA. RESEARCHERS NEED TO PRACTICE ETHICS AND A CODE OF CONDUCT WHILE MAKING OBSERVATIONS OR DRAWING CONCLUSIONS.
2. THE ANALYSIS IS BASED ON LOGICAL REASONING AND INVOLVES BOTH INDUCTIVE AND DEDUCTIVE METHODS.
3. REAL-TIME DATA AND KNOWLEDGE IS DERIVED FROM ACTUAL OBSERVATIONS IN NATURAL SETTINGS.
4. THERE IS AN IN-DEPTH ANALYSIS OF ALL DATA COLLECTED SO THAT THERE ARE NO ANOMALIES ASSOCIATED WITH IT.
5. IT CREATES A PATH FOR GENERATING NEW QUESTIONS. EXISTING DATA HELPS CREATE MORE RESEARCH OPPORTUNITIES.
6. IT IS ANALYTICAL AND USES ALL THE AVAILABLE DATA SO THAT THERE IS NO AMBIGUITY IN INFERENCE.
7. ACCURACY IS ONE OF THE MOST CRITICAL ASPECTS OF RESEARCH. THE INFORMATION MUST BE ACCURATE AND CORRECT. FOR EXAMPLE, LABORATORIES PROVIDE A CONTROLLED ENVIRONMENT TO COLLECT DATA. ACCURACY IS MEASURED IN THE INSTRUMENTS USED, THE CALIBRATIONS OF INSTRUMENTS OR TOOLS, AND THE EXPERIMENT'S FINAL RESULT.

## IMPORTANCE:

AT MOST, TO FIND OUT A NEW FACT WHICH IS HIDDEN AND TO INVENT NEW

- TO ACHIEVE NEW INSIGHTS INTO THE PROBLEM
- TO INVENT NEW SOLUTIONS TO THE PROBLEMS
- TO DISCOVER THE FACTS WITH EXISTING IN THE WORLD

## RESEARCH PROCESS:

### 1. PROBLEM DEFINITION:

A RESEARCH PROBLEM MUST BE IDENTIFIED AND DEFINED WITHOUT ANY AMBIGUITY. IF A RESEARCHER PROCEEDS WITH ILL-DEFINED PROBLEMS HE OR SHE MAY END UP WITH MISLEADING CONCLUSIONS.

### 2. OBJECTIVES

IN THIS STAGE THE RESEARCHER MUST FINALIZE THE FOLLOWING ASPECTS;

RESEARCH QUESTIONS, ARE THE PROBLEMS WHICH ARE NOT RESOLVED TILL DATE

HYPOTHESIS, AN ASSUMPTION ABOUT A POPULATION OF STUDY.

### 3. RESEARCH DESIGN

IT PROVIDES A COMPLETE GUIDELINES FOR DATA COLLECTION. THE MAIN CONCEPTS OF RESEARCH DESIGN ARE

- SELECTION OF RESEARCH APPROACH
- DESIGNING OF SAMPLING PLAN
- DESIGN OF QUESTIONNAIRE

### 4. DATA COLLECTION

DATA IS THE BASIC INPUT TO ANY DECISION MAKING PROCESS AND IS CLASSIFIED INTO TWO TYPES

PRIMARY DATA, COLLECTED THROUGH SURVEYS INTERVIEWS, OBSERVATIONS ETC.

SECONDARY DATA, COLLECTED THROUGH BOOKS MAGAZINES COMPANY REPORTS ETC.

## 5. DATA ANALYSIS

AFTER DATA IS COLLECTED PROPER TOOLS AND TECHNIQUES SHOULD BE USED FOR ANALYSIS.

VARIOUS TOOLS FREQUENCY DISTRIBUTION PERCENTAGE DISTRIBUTION CHARTS AND TABLES.

## 6. INTERPRETATION OF RESULTS:

THE RESEARCHERS SHOULD INFER THE RESULTS OF THE RESEARCH PROBLEM FROM THAT OF MODEL BY TAKING RESERVATIONS AND THE KIND OF TRANSFORMATION WHICH TOOK PLACE WHILE MODIFYING THE ORIGINAL PROBLEM.

## 7. VALIDATION OF RESULTS:

THE RESULTS OF THE INTERPRETATION MUST BE VALIDATED BY USING PAST DATA. IF THERE IS ANY MISMATCH BETWEEN THE RESULTS AND THE MODEL AND THAT OF REAL WORLD PROBLEM IN THE PAST THAN THE ASSUMPTIONS AND MODELLING EXERCISE SHOULD BE REVISITED TILL THE RESULTS ARE VALIDATED.

## TYPES OF RESEARCH

### A. DESCRIPTIVE VS ANALYTICAL

DESCRIPTIVE RESEARCH INCLUDES SURVEYS AND FACT FINDING ENQUIRIES OF DIFFERENT KINDS.

THE MAIN PURPOSE IS DESCRIPTION OF STATE OF AFFAIRS AS IT EXISTS AT PRESENT

FOR EXAMPLE, FREQUENCY OF SHOPPING OR WHICH KIND OF PEOPLE ARE BUYING A PARTICULAR PRODUCT.

THE RESEARCHER IN ANALYTICAL RESEARCH HAS TO USE FACTS WHICH ARE ALREADY AVAILABLE AND ANALYZE THESE TO MAKE A CRITICAL EVALUATION. IT INVOLVES AN IN DEPTH STUDY.

FOR EXAMPLE, TURNOVER OF ORGANISATION IN THE NEXT YEAR FROM LAST YEAR.

### B. APPLIED VS FUNDAMENTAL

APPLIED RESEARCH AIMS AT FINDING A SOLUTION FOR AN IMMEDIATE PROBLEM WHICH IS FACING BY THE SOCIETY OR INDUSTRY.

FOR EXAMPLE FINDING MEDICINE FOR A DISEASE

FUNDAMENTAL RESEARCH IS MAINLY CONCERNED WITH GENERALIZATIONS AND WITH THE FORMULATION OF A THEORY.

FOR EXAMPLE NEWTON'S CONTRIBUTIONS.

### C. QUALITATIVE VS QUANTITATIVE

QUALITATIVE RESEARCH IS CONCERNED WITH QUALITATIVE PHENOMENA.

FOR EXAMPLE, REASONS OF HUMAN BEHAVIOUR

QUANTITATIVE RESEARCH IS BASED ON MEASUREMENT OF QUANTITY OR AMOUNT. IT IS APPLICABLE TO THE PHENOMENA THAT CAN BE EXPRESSED IN TERMS OF QUANTITY.

#### D. CONCEPTUAL VS EMPIRICAL

CONCEPTUAL RESEARCH IS THAT RELATED TO SOME ABSTRACT OR THEORY AND IT IS GENERALLY USED BY PHILOSOPHERS.

EMPIRICAL RESEARCH IS DATA BASED RESEARCH COMING UP WITH CONCLUSIONS OR OBSERVATIONS ALONE.

#### E. ONE TIME VS LONGITUDINAL

ONE TIME RESEARCH IS CONFINED TO A SINGLE TIME PERIOD

LONGITUDINAL RESEARCH IS CARRIED OUT FOR SEVERAL YEARS.

### **FORMULATION OF HYPOTHESIS:**

#### **1. LEVEL OF SIGNIFICANCE**

THE LEVEL OF SIGNIFICANCE IS THE PROBABILITY OF REJECTING A TRUE NULL HYPOTHESIS THAT IS THE PROBABILITY OF "TYPE I ERROR" AND IS DENOTED BY  $\alpha$ . THE FREQUENTLY USED VALUES OF  $\alpha$  ARE 0.05; 0.01; 0.1 ETC.

WHEN,  $\alpha = 0.05$  IT MEANS THAT LEVEL OF SIGNIFICANCE IS 5%. IN FACT  $\alpha$  SPECIFIES THE CRITICAL REGION. A COMPUTED VALUE OF THE TEST STATISTIC THAT FALLS IN THE CRITICAL REGION (CR) IS SAID TO BE SIGNIFICANT. SO,  $\alpha$  IS CALLED THE LEVEL OF SIGNIFICANCE.

#### **2. CRITICAL/ REJECTION REGION**

THE CRITICAL REGION (CR) OR REJECTION REGION (RR) IS THE AREA UNDER THE CURVE BEYOND CERTAIN LIMITS IN WHICH THE POPULATION VALUE IS UNLIKELY TO FALL BY CHANCE ONLY WHEN THE NULL HYPOTHESIS IS ASSUMED TO BE TRUE. IF AN OBSERVED VALUE FALLS IN THIS REGION  $H_0$  IS REJECTED AND THE OBSERVED VALUE IS SAID TO BE SIGNIFICANT. IN A WORD, THE REGION FOR WHICH  $H_0$  IS REJECTED IS CALLED CRITICAL REGION OR REJECTION REGION.

#### **3. CONFIDENCE INTERVAL**

CONFIDENCE INTERVAL IS THE INTERVAL MARKED BY LIMITS WITHIN WHICH THE POPULATION VALUE LIES BY CHANCE AND THE HYPOTHESIS IS CONSIDERED TO BE TENABLE. IF AN OBSERVED VALUE FALLS IN CONFIDENCE INTERVAL  $H_0$  IS ACCEPTED.

#### **4. CRITICAL VALUES**

THE VALUES OF THE TEST STATISTIC WHICH SEPARATES CRITICAL REGION FROM CONFIDENCE REGION (ACCEPTANCE REGION) ARE CALLED CRITICAL VALUES.

## 5. STANDARD DEVIATION

THE STANDARD DEVIATION IS THE MOST FREQUENTLY CALCULATED MEASURE OF VARIABILITY OR DISPERSION IN A SET OF DATA POINTS. THE STANDARD DEVIATION VALUE REPRESENTS THE AVERAGE DISTANCE OF A SET OF SCORES FROM THE MEAN OR AVERAGE SCORE.

## 6. STANDARD ERROR

THE STANDARD ERROR IS AN ESTIMATE OF THE STANDARD DEVIATION OF A STATISTIC. THE STANDARD ERROR IS IMPORTANT BECAUSE IT IS USED TO COMPUTE OTHER MEASURES, LIKE CONFIDENCE INTERVALS AND MARGINS OF ERROR. THE STANDARD ERROR IS COMPUTED FROM KNOWN SAMPLE STATISTICS, AND IT PROVIDES AN UNBIASED ESTIMATE OF THE STANDARD DEVIATION OF THE STATISTIC.

## 7. DEGREE OF FREEDOM

DEGREE OF FREEDOM REFERS TO THE NUMBER OF VALUES WHICH ARE FREE TO VARY AFTER WE HAVE GIVEN THE NUMBER OF RESTRICTIONS IMPOSED UPON THE DATA. IT IS COMMONLY ABBREVIATED BY DF. FOR EXAMPLE, IF YOU HAVE TO TAKE TEN DIFFERENT COURSES TO GRADUATE, AND ONLY TEN DIFFERENT COURSES ARE OFFERED, THEN YOU HAVE NINE DEGREES OF FREEDOM. NINE SEMESTERS YOU WILL BE ABLE TO CHOOSE WHICH CLASS TO TAKE; THE TENTH SEMESTER, THERE WILL ONLY BE ONE CLASS LEFT TO TAKE - THERE IS NO CHOICE, IF YOU WANT TO GRADUATE.

## 8. ONE-TAILED AND TWO-TAILED TESTS

ONE-TAILED TEST: A TEST IN WHICH THE CRITICAL REGION IS LOCATED IN ONE TAIL OF THE DISTRIBUTION OF TEST OF STATISTIC IS CALLED ONE-TAILED TEST. THERE ARE TWO TYPES OF ONE-TAILED TEST IN TEST OF HYPOTHESIS –

(A) RIGHT TAILED TEST AND (B) LEFT TAILED TEST.

A TEST IN WHICH CRITICAL REGION IS LOCATED IN RIGHT TAIL OF THE DISTRIBUTION OF TEST STATISTIC IS CALLED RIGHT TAILED TEST OR UPPER ONE TAILED TEST. A TEST IN WHICH CRITICAL REGION IS LOCATED IN LEFT TAIL OF THE DISTRIBUTION OF TEST STATISTIC IS CALLED LEFT TAILED TEST OR LOWER ONE TAILED TEST.

### PROCEDURE FOR/ STEPS OF HYPOTHESIS TESTING:

ALL HYPOTHESIS TESTS ARE CONDUCTED THE SAME WAY. THE RESEARCHER STATES A HYPOTHESIS TO BE TESTED, FORMULATES AN ANALYSIS PLAN, ANALYZES SAMPLE DATA ACCORDING TO THE PLAN, AND ACCEPTS OR REJECTS THE NULL HYPOTHESIS, BASED ON RESULTS OF THE ANALYSIS.

1. ASSUMPTION: IF THERE ARE ANY ASSUMPTION ABOUT THE NORMALITY OF THE POPULATION DISTRIBUTION

EQUALITY OF VARIANCE, INDEPENDENCE OF SAMPLES, ETC. THEY SHOULD BE STATED.

2. STATE THE HYPOTHESES: EVERY HYPOTHESIS TEST REQUIRES THE ANALYST TO STATE A NULL HYPOTHESIS ( $H_0$ ) AND AN ALTERNATIVE HYPOTHESIS ( $H_1$ ). THE HYPOTHESES ARE STATED IN SUCH A WAY THAT THEY ARE MUTUALLY EXCLUSIVE. THAT IS, IF ONE IS TRUE, THE OTHER MUST BE FALSE; AND VICE VERSA.

3. SET UP A STATISTICAL SIGNIFICANCE LEVEL: SET THE SIGNIFICANCE LEVEL (A) IF NOT ALREADY GIVEN. A SPECIFIES THE CRITICAL REGION. OFTEN, RESEARCHERS CHOOSE SIGNIFICANCE LEVELS EQUAL TO 0.01, 0.05, OR 0.10; BUT ANY VALUE BETWEEN 0 AND 1 CAN BE USED.

4. DETERMINATION OF A SUITABLE TEST STATISTIC: TEST STATISTIC IS A FORMULA OR FUNCTION ON SAMPLE DATA. A GENERAL FORMULA FOR TEST STATISTIC – WHEN THE NULL HYPOTHESIS INVOLVES A MEAN OR PROPORTION, USE EITHER OF THE FOLLOWING EQUATIONS TO COMPUTE THE TEST STATISTIC.

TEST STATISTIC = (STATISTIC - PARAMETER) / (STANDARD DEVIATION OF STATISTIC) TEST STATISTIC

$$= (\text{STATISTIC} - \text{PARAMETER}) / (\text{STANDARD ERROR OF STATISTIC})$$

5. DETERMINE THE CRITICAL REGION: IT IS IMPORTANT TO SPECIFY THE ACCEPTANCE (CONFIDENCE INTERVAL) AND REJECTION (CRITICAL) REGION BEFORE THE SAMPLE IS TAKEN, WHICH VALUES OF THE TEST STATISTIC WILL LEAD TO A REJECTION OR ACCEPTANCE OF  $H_0$ .

6. DOING COMPUTATIONS: COMPUTE THE APPROPRIATE TEST STATISTIC BASED ON SAMPLE INFORMATION.

7. INTERPRET THE RESULTS: EXAMINE WHETHER THE CALCULATED TEST STATISTIC FALLS IN THE ACCEPTANCE OR REJECTION REGION. IF IT FALLS IN THE REJECTION REGION (CRITICAL REGION), THE NULL HYPOTHESIS IS REJECTED. IF IT FALLS IN THE ACCEPTED REGION, THE NULL HYPOTHESIS IS ACCEPTED.

8. MAKING DECISION: MAKE THE SUITABLE CONCLUSION FOR THE PROBLEM UNDER STUDY.

### RESEARCH DESIGN:

RESEARCH DESIGN IS THE PREPARATION OF THE DESIGN OF THE RESEARCH PROJECT. IT CONSTITUTES THE BLUEPRINT FOR THE COLLECTION, MEASUREMENT AND ANALYSIS OF DATA. RESEARCH DESIGN DECISIONS REVOLVE AROUND THE FOLLOWING QUESTIONS

- WHAT IS THE STUDY ABOUT?
- WHY IS THE STUDY BEING MADE?
- WHERE WILL BE THE STUDY CARRIED OUT?
- WHAT TYPE OF DATA IS REQUIRED?
- WHERE CAN THE REQUIRED DATA BE FOUND
- WHAT WOULD BE THE SAMPLE DESIGN?
- WHAT TECHNIQUES OF DATA COLLECTION WILL BE USED?
- HOW WILL THE DATA BE ANALYZED
- IN WHAT STAGE WILL THE REPORT BE PREPARED?

### RESEARCH DESIGN

LOGICAL AND SYSTEMATIC PLANNING AND INDICATES A PLAN OF ACTION TO BE CARRIED OUT. RESEARCH DESIGN IS AN ARRANGEMENT OF CONDITIONS FOR COLLECTION AND ANALYSIS OF DATA.

### NATURE:

THE NATURE OF RESEARCH DESIGN CONTAINS

- PRESENTATION OF RESEARCH PROBLEM
- PROCEDURES AND TECHNIQUES USED TO COLLECT THE DATA
- POPULATION TO BE STUDIED
- METHODS TO BE USED IN PROCESSING AND ANALYZING THE DATA

TYPES:

## 1. EXPLORATORY RESEARCH

EXPLORATORY RESEARCH DESIGN PROVIDES OPPORTUNITY FOR CONSIDERING DIFFERENT ASPECTS OF A PROBLEM . IT IS RELATED TO

LITERATURE SURVEY, CONCERNS AND METHOD OF FORMULATING A RESEARCH PROBLEM.

EXPERIENCE SURVEY INVOLVES EXPERIENCE WITH PEOPLE

ANALYSIS OF INSIGHT SIMULATION, A METHOD FOR SUGGESTING HYPOTHESIS FOR RESEARCH.

## 2. DESCRIPTIVE RESEARCH

DESCRIPTIVE RESEARCH DESIGNS ARE CONCERNED WITH DESCRIBING THE CHARACTERISTICS OF INDIVIDUAL OR GROUP .THE AIM IS TO OBTAIN COMPLETE AND ACCURATE INFORMATION ABOUT THE POPULATION OF THE STUDY.

IT CONCENTRATES ON

- SELECTION OF RESEARCH PROBLEM
- IDENTIFICATION OF TARGET POPULATION
- CHOOSING SAMPLING FRAME AND PLAN
- FRAMING THE QUESTIONNAIRE
- COLLECTION OF DATA
- INTERPRETATION OF RESULTS
- FINDING THE FACTS

## SAMPLING DESIGN:

A PROCESS OF SELECTING A SUBSET OF RANDOMIZED NUMBER OF MEMBERS OF THE POPULATION OF A STUDY AND COLLECTING THE DATA ABOUT THE ATTRIBUTES.

IN OTHER WORDS, A SAMPLE DESIGN IS A DEFINITE PLAN FOR OBTAINING A SAMPLE FROM A GIVEN POPULATION. THE ELEMENTS OF SAMPLE ARE CALLED AS UNITS OR OBSERVATIONS.

## ADVANTAGES:

A SYSTEMATIC PLAN THAT CONCENTRATES ON HOW A SAMPLE SHOULD BE SELECTED AND WHAT SIZE IT WOULD BE. SAMPLING DESIGN HAS THE FOLLOWING ADVANTAGES,

- LESS TIME TO COLLECT DATA
- MORE ACCURACY
- LESS COST FOR DATA COLLECTION

## METHODS:

SAMPLING METHODS ARE CLASSIFIED INTO TWO BROAD CATEGORIES. THEY ARE

### **A. PROBABILITY SAMPLING METHODS:**

THE PROBABILITY SAMPLING METHODS ARE SUB CLASSIFIED INTO;

#### **1. SYSTEMATIC SAMPLING:**

SYSTEMATIC SAMPLING MEANS SELECTING THE 1<sup>TH</sup> ELEMENT ON A LIST. IT IS EMPLOYED IF THE COMPLETE LISTS OF SAMPLING UNITS ARE AVAILABLE. SYSTEMATIC SAMPLING CONCENTRATES ON SELECTING THE FIRST ELEMENT.

##### POSITIVES:

- IT IS VERY CONVENIENT
- IT IS TOO ECONOMICAL.

##### NEGATIVES:

- IT IS LESS REPRESENTATIVE.
- SELECTION OF FIRST ELEMENT IS STRICTLY AT RANDOM.

#### **2. CLUSTER SAMPLING:**

IN CLUSTER SAMPLING, TOTAL POPULATION IS DIVIDED INTO A NUMBER OF RELATIVELY SMALL SUB DIVISIONS (CLUSTERS) AND SOME ARE RANDOMLY SELECTED FOR THE STUDY. CLUSTER SAMPLING IS KNOWN AS AREA SAMPLING IF THE SUB DIVISIONS ARE GEOGRAPHICAL LOCATIONS.

THE MAIN ADVANTAGE IS ECONOMICAL AND THE MAIN DISADVANTAGE IS LESS PRECISE.



### 3. STRATIFIED RANDOM SAMPLING:

UNDER THIS TYPE, THE HETEROGENEOUS POPULATION IS DIVIDED INTO HOMOGENOUS GROUPS (STRATA OR STRATUM) AND SOME ARE RANDOMLY SELECTED FOR RESEARCH.

#### MERITS:

- COVERS A MASS POPULATION
- GIVES MORE ACCURATE INFORMATION.

#### DEMERITS:

- REQUIRES LOT OF CARE
- REQUIRES AUXILIARY INFORMATION.

### 4. MULTI STAGE SAMPLING:

THIS TECHNIQUE IS MEANT FOR LARGE ENQUIRIES. UNDER THIS ONE, THE FIRST STAGE MAY BE ABLE TO SELECT LARGE PRIMARY SAMPLING UNITS SUCH AS STATES, THEN DISTRICTS AND THEN TOWNS AND FINALLY CERTAIN FAMILIES.

#### PROS:

- IT IS HIGHLY FLEXIBLE
- VERY USEFUL IN FORMULATING POLICIES.

#### CONS:

- LESS ACCURATE
- DIVISION IS SOMEWHAT TOUGH.

## **B. NON – PROBABILITY SAMPLING:**

THE NON - PROBABILITY SAMPLING METHODS ARE SUB CLASSIFIED INTO;

### **1. CONVENIENCE SAMPLING:**

INTERVIEWERS WILL DECIDE THE CHOICE OF SAMPLING UNITS BASED ON THEIR CONVENIENCE. GENERALLY SAMPLING UNITS ARE SELECTED FROM

- TELEPHONE DIRECTORY
- DEPARTMENTAL STORES
- NEWS PAPER SUBSCRIBER'S LIST.

### **2. JUDGMENT SAMPLING:**

SAMPLING UNITS ARE SELECTED ON THE ADVICE OF SOME EXPERT OR BY THE OPINIONS OF THE RESEARCHER HIMSELF.

### **3. QUOTA SAMPLING:**

POPULATION IS DIVIDED INTO NUMBER OF GROUPS BASED ON SOME CRITERION,

- OLD AGE
- MIDDLE AGE
- YOUNG AGE

## DATA:

THE SEARCH FOR ANSWER TO RESEARCH QUESTIONS REQUIRES CERTAIN COLLECTION OF DATA. THE RELIABILITY OF MANAGERIAL DECISIONS DEPENDS ON THE QUALITY OF DATA.

THERE ARE TWO TYPES OF DATA NAMELY:

### PRIMARY DATA:

DATA WHICH IS COLLECTED FROM THE FIELD UNDER THE CONTROL AND SUPERVISION OF AN INVESTIGATOR. THIS TYPE OF DATA IS GENERALLY A FRESH DATA AND COLLECTED FOR THE FIRST TIME.

### SECONDARY DATA:

DATA WHICH IS ALREADY COLLECTED BY SOMEONE ELSE AND BEEN PASSED THROUGH THE STATISTICAL PROCESS. NORMALLY SECONDARY DATA IS COLLECTED FROM JOURNALS, MAGAZINES, ANNUAL REPORTS ETC.

### PRIMARY DATA Vs SECONDARY DATA:

THE DISTINCTION BETWEEN PRIMARY DATA AND SECONDARY DATA IS ONLY RELATIVE. THE PRIMARY DATA OF ONE STUDY WILL SERVE AS SECONDARY DATA FOR ANOTHER STUDY.

### DATA COLLECTION METHODS:

AS STATED EARLIER , THE SECONDARY DATA IS COLLECTED THROUGH JOURNALS, ONLINE SITES, MAGAZINES , ANNUAL REPORTS OF THE COMPANY ETC. BUT THE PRIMARY DATA IS COLLECTED THROUGH VARIOUS METHODS NAMELY;

#### **1. OBSERVATION METHOD:**

IT IS THE MOST COMMONLY USED METHOD AND IN THIS METHOD, THE INFORMATION IS SOUGHT BY WAY OF INVESTIGATOR'S OWN DIRECT OBSERVATION WITHOUT ASKING FROM THE RESPONDENT. OBSERVATION METHOD CAN BE EITHER CONTROLLED OR UNCONTROLLED.

##### CONTROLLED OBSERVATION METHOD:

IF THE OBSERVATION TAKES PLACE ACCORDING TO DEFINITE PRE-ARRANGED PLANS, THEN IT IS TERMED AS CONTROLLED OBSERVATION.

##### UNCONTROLLED OBSERVATION METHOD:

IF THE OBSERVATION TAKES PLACE IN THE NATURAL SETTING, IT IS TERMED AS AN UNCONTROLLABLE OBSERVATION METHOD.

#### **2. INTERVIEW METHOD:**

DATA COLLECTION IN INTERVIEW METHOD INVOLVES PRESENTATION OF ORAL VERBAL STIMULI AND REPLY IN ORAL VERBAL RESPONSES.

- a. PERSONAL INTERVIEW: REQUIRES A PERSON KNOWN AS INTERVIEWER ASKING QUESTIONS GENERALLY IN A FACE – TO – FACE CONTACT TO THE OTHER PERSON. IT IS VERY EXPENSIVE AND IT IS NOT POSSIBLE IN CASE OF PEER MEMBERS.
- b. TELEPHONE INTERVIEW: COLLECTING INFORMATION THROUGH CONTACTING RESPONDENTS ON TELEPHONE ITSELF. IT IS WIDELY USED INDUSTRIAL SURVEYS AND IT IS FASTER, FLEXIBLE AND CHEAPER.

- c. QUESTIONNAIRE: SET OF QUESTIONS IN A STRUCTURED MANNER. GENERALLY THE QUESTIONS ARE OF
1. OPEN ENDED QUESTIONS: NO ALTERNATIVES ARE GIVEN. THE ANSWER CAN BE IN THE RESPONDENTS OWN WORDS
  2. MULTIPLE CHOICE QUESTIONS: THE RESPONDENTS HAVE TO CHOOSE FROM MORE THAN TWO GIVEN ALTERNATIVES.
  3. DICHOTOMOUS QUESTIONS: THE RESPONDENTS HAS TO CHOOSE BETWEEN TWO GIVEN ALTERNATIVES

ESSENTIAL FACTORS WHILE DESIGNING A QUESTIONNAIRE:

THE FOLLOWING CONSIDERATIONS SHOULD BE KEPT IN MIND WHILE PREPARING A QUESTIONNAIRE:

1. THE PERSON CONDUCTING THE SURVEY MUST INTRODUCE HIMSELF AND STATE THE PRIMARY OBJECTIVE OF SURVEY.
2. THE QUESTIONS MUST BE ARRANGED IN A LOGICAL ORDER.
3. THE QUESTIONS SHOULD BE SHORT AND SIMPLE.
4. PERSONAL QUESTIONS SHOULD BE AVOIDED.
5. OPEN ENDED QUESTIONS SHOULD BE MINIMIZED.
6. QUESTIONS REGARDING THE NUMBER BASED ON THE TYPE OF SURVEY.
7. QUESTIONS REQUIRING CALCULATIONS SHOULD BE AVOIDED.

SAMPLE QUESTIONNAIRE:

QUESTIONNAIRE ON “WORKERS PARTICIPATION IN MANAGEMENT” KOTHAGUDEM THERMAL POWER STATION

NAME: \_\_\_\_\_ DEPARTMENT: \_\_\_\_\_

DESIGNATION: \_\_\_\_\_ AGE: \_\_\_\_\_

YEARS OF SERVICE IN KTPS: \_\_\_\_\_ GRADE: \_\_\_\_\_

---

I. WORKERS PARTICIPATION IN MANAGEMENT

- 1) WORKERS PARTICIPATION WOULD LEAD TO IMPROVEMENT IN PRODUCTION/ PRODUCTIVITY?  
A) AGREE                                      B) NEUTRAL                                      C) DISAGREE
- 2) WORKERS PARTICIPATION WOULD RESULT IN BETTER UNDERSTANDING AMONG MANAGERS, SUPERVISORS AND WORKERS?  
A) AGREE                                      B) NEUTRAL                                      C) DISAGREE
- 3) WORKERS PARTICIPATION WOULD HELP IN IMPROVING INDUSTRIAL RELATIONS?  
A) AGREE                                      B) NEUTRAL                                      C) DISAGREE
- 4) IN YOUR ORGANIZATION THE WORKER IS GENUINELY INTERESTED IN PARTICIPATION AT VARIOUS LEVELS?  
A) AGREE                                      B) NEUTRAL                                      C) DISAGREE

5) IN YOUR ORGANIZATION MANAGERS AT VARIOUS LEVELS ARE ADEQUATELY INVOLVED IN DECISION-MAKING?

A) AGREE

B) NEUTRAL

C) DISAGREE

6) ARE SURE INTERESTED TO PARTICIPATE IN THE MANAGEMENT ACTIVITIES?

a) YES

B) NO

7) PLEASE GIVE YOUR OPINION ABOUT THE EFFECTIVENESS OF EXISTING WORKERS PARTICIPATION IN MANAGEMENT IN YOUR ORGANIZATION?

A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

8) DO YOU THINK THAT WORKERS PARTICIPATION WOULD REALLY HELP TO MAINTAIN HARMONIOUS RELATIONSHIP BETWEEN WORKERS AND EMPLOYER?

A) YES

B) NO

## II) WORKING CONDITIONS:

1. GIVE YOUR OPINION ABOUT THE SUPERIORS ROLE AT WORK SPOT?

A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

2. WHAT IS YOUR OPINION ABOUT WELFARE FACILITIES IMPLEMENTED BY THE KTPS MANAGEMENT ?

A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

3. WHAT IS YOUR OPINION ABOUT LIGHTING AT WORK LOCATION?

A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

## III) WAGE & SALARY :

1. ARE YOU SURE OF YOUR PRESENT WAGE STRUCTURE?

A) YES

B) NO

2. ARE YOU SATISFIED WITH THE PRESENT WAGE/SALARY PACKAGE AND OTHER ATTENDANT BENEFITS

A) YES

B) NO

3. IF YES, PLEASE INDICATE THE SATISFACTION LEVEL ?

A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

#### IV) TRADE UNIONS

1. GIVE YOUR OPINION ON TRADE UNIONS PART IN WPM IN YOUR ORGANIZATION? A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

2 . HOW UNION MANAGEMENT RELATIONSHIP IN KTPS?

A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

3. HOW IS THE EMPLOYEE-EMPLOYEE RELATION IN KTPS?

A) EXCELLENT

B) GOOD

C) AVERAGE

D) POOR

#### V) COLLECTIVE BARGAINING:

1. COLLECTIVE BARGAINING IN KTPS HAS STRENGTHENED BOTH THE MANAGEMENT AND TRADE UNIONS?

A) YES

B) NO

2. DO YOU FEEL THAT COLLECTIVE BARGAINING CAN SOLVE THE PROBLEMS?

A) YES

B) NO

3. DO UNIONS CONSULT YOU (MEMBERS) BEFORE THEY SIT AROUND THE COLLECTIVE BARGAINING?

a) YES

B) NO

GIVE YOUR SUGGESTIONS TO IMPROVE "WPM" PROGRAMME IN YOUR ORGANIZATION

## MEASUREMENT AND SCALES TECHNIQUES:

SCALING TECHNIQUE IS A METHOD OF PLACING RESPONDENTS IN CONTINUATION OF GRADUAL CHANGE IN THE PRE-ASSIGNED VALUES, SYMBOLS OR NUMBERS BASED ON THE FEATURES OF A PARTICULAR OBJECT AS PER THE DEFINED RULES. ALL THE SCALING TECHNIQUES ARE BASED ON FOUR PILLARS, I.E., ORDER, DESCRIPTION, DISTANCE AND ORIGIN. THE MARKETING RESEARCH IS HIGHLY DEPENDABLE UPON THE SCALING TECHNIQUES, WITHOUT WHICH NO MARKET ANALYSIS CAN BE PERFORMED.

MEASUREMENT SCALES ARE THE MAPPINGS USED FOR REPRESENTING THE EMPIRICAL RELATION SYSTEM. IT

IS MAINLY OF 5 TYPES –

### **A. NOMINAL SCALE:**

IT PLACES THE ELEMENTS IN A CLASSIFICATION SCHEME. THE CLASSES WILL NOT BE ORDERED. EACH AND EVERY ENTITY SHOULD BE PLACED IN A PARTICULAR CLASS OR CATEGORY BASED ON THE VALUE OF THE ATTRIBUTE.

#### TYPES OF NOMINAL SCALES:

1. DICHOTOMOUS: A NOMINAL SCALE THAT HAS ONLY TWO LABELS IS CALLED 'DICHOTOMOUS'; *FOR EXAMPLE, YES/NO.*
2. NOMINAL WITH ORDER: THE LABELS ON A NOMINAL SCALE ARRANGED IN AN ASCENDING OR DESCENDING ORDER IS TERMED AS 'NOMINAL WITH ORDER'; *FOR EXAMPLE, EXCELLENT, GOOD, AVERAGE, POOR, WORST.*
3. NOMINAL WITHOUT ORDER: SUCH NOMINAL SCALE WHICH HAS NO SEQUENCE, IS CALLED 'NOMINAL WITHOUT ORDER'; *FOR EXAMPLE, BLACK, WHITE.*

### **B. ORDINAL SCALE:**

IT PLACES THE ELEMENTS IN AN ORDERED CLASSIFICATION SCHEME. IT HAS THE FOLLOWING CHARACTERISTICS –

- THE EMPIRICAL RELATION SYSTEM CONSISTS OF CLASSES THAT ARE ORDERED WITH RESPECT TO THE ATTRIBUTE.
- ANY MAPPING THAT PRESERVES THE ORDERING IS ACCEPTABLE.
- THE NUMBERS REPRESENT RANKING ONLY. HENCE, ADDITION, SUBTRACTION, AND OTHER ARITHMETIC OPERATIONS HAVE NO MEANING.

*FOR EXAMPLE, AT AMAZON. IN, EVERY PRODUCT HAS A CUSTOMER REVIEW SECTION WHERE THE BUYERS RATE THE LISTED PRODUCT ACCORDING TO THEIR BUYING EXPERIENCE, PRODUCT FEATURES, QUALITY, USAGE, ETC.*

THE RATINGS SO PROVIDED ARE AS FOLLOWS:

- 5 STAR – EXCELLENT
- 4 STAR – GOOD
- 3 STAR – AVERAGE
- 2 STAR – POOR
- 1 STAR – WORST

### C. INTERVAL SCALE:

THIS SCALE CAPTURES THE INFORMATION ABOUT THE SIZE OF THE INTERVALS THAT SEPARATE THE CLASSIFICATION. HENCE, IT IS MORE POWERFUL THAN THE NOMINAL SCALE AND THE ORDINAL SCALE.

IT HAS THE FOLLOWING CHARACTERISTICS –

- ❑ IT PRESERVES ORDER LIKE THE ORDINAL SCALE.
- ❑ IT PRESERVES THE DIFFERENCES BUT NOT THE RATIO.
- ❑ ADDITION AND SUBTRACTION CAN BE PERFORMED ON THIS SCALE BUT NOT MULTIPLICATION OR DIVISION.

FOR EXAMPLE; A SURVEY CONDUCTED BY AN AUTOMOBILE COMPANY TO KNOW THE NUMBER OF VEHICLES OWNED BY THE PEOPLE LIVING IN A PARTICULAR AREA WHO CAN BE ITS PROSPECTIVE CUSTOMERS IN FUTURE. IT ADOPTED THE INTERVAL SCALING TECHNIQUE FOR THE PURPOSE AND PROVIDED THE UNITS AS 1, 2, 3, 4, 5, AND 6 TO SELECT FROM.

IN THE SCALE MENTIONED ABOVE, EVERY UNIT HAS THE SAME DIFFERENCE, I.E., 1, WHETHER IT IS BETWEEN 2 AND 3 OR BETWEEN 4 AND 5.

### D. RATIO SCALE

THIS IS THE MOST USEFUL SCALE OF MEASUREMENT. HERE, AN EMPIRICAL RELATION EXISTS TO CAPTURE RATIOS. IT HAS THE FOLLOWING CHARACTERISTICS –

- ❑ IT IS A MEASUREMENT MAPPING THAT PRESERVES ORDERING, THE SIZE OF INTERVALS BETWEEN THE ENTITIES AND THE RATIO BETWEEN THE ENTITIES.
- ❑ THERE IS A ZERO ELEMENT, REPRESENTING TOTAL LACK OF THE ATTRIBUTES.
- ❑ THE MEASUREMENT MAPPING MUST START AT ZERO AND INCREASE AT EQUAL INTERVALS, KNOWN AS UNITS.
- ❑ ALL ARITHMETIC OPERATIONS CAN BE APPLIED.

FOR EXAMPLE, A HEALTH PRODUCT MANUFACTURING COMPANY SURVEYED TO IDENTIFY THE LEVEL OF OBESITY IN A PARTICULAR LOCALITY. IT RELEASED THE FOLLOWING SURVEY QUESTIONNAIRE: SELECT A CATEGORY TO WHICH YOUR WEIGHT BELONGS TO:

LESS THAN 40 KILOGRAMS

- 40-59 KILOGRAMS
- 60-79 KILOGRAMS
- 80-99 KILOGRAMS
- 100-119 KILOGRAMS
- 120 KILOGRAMS AND MORE



#### E. ABSOLUTE SCALE:

ON THIS SCALE, THERE WILL BE ONLY ONE POSSIBLE MEASURE FOR AN ATTRIBUTE. HENCE, THE ONLY POSSIBLE TRANSFORMATION WILL BE THE IDENTITY TRANSFORMATION.

IT HAS THE FOLLOWING CHARACTERISTICS –

- ☐ THE MEASUREMENT IS MADE BY COUNTING THE NUMBER OF ELEMENTS IN THE ENTITY SET.
- ☐ THE ATTRIBUTE ALWAYS TAKES THE FORM “NUMBER OF OCCURRENCES OF X IN THE ENTITY”.
- ☐ THERE IS ONLY ONE POSSIBLE MEASUREMENT MAPPING, NAMELY THE ACTUAL COUNT.
- ☐ ALL ARITHMETIC OPERATIONS CAN BE PERFORMED ON THE RESULTING COUNT.

**F. LIKERT SCALE:** IN THE LIKERT SCALE, THE RESEARCHER PROVIDES SOME STATEMENTS AND ASKS THE RESPONDENTS TO MARK THEIR LEVEL OF AGREEMENT OR DISAGREEMENT OVER THESE STATEMENTS BY SELECTING ANY ONE OF THE OPTIONS FROM THE FIVE GIVEN ALTERNATIVES.

FOR EXAMPLE, A SHOES MANUFACTURING COMPANY ADOPTED THE LIKERT SCALE TECHNIQUE FOR ITS NEW SPORTS SHOE RANGE NAMED Z SPORTS SHOES. THE PURPOSE IS TO KNOW THE AGREEMENT OR DISAGREEMENT OF THE RESPONDENTS. FOR THIS, THE RESEARCHER ASKED THE RESPONDENTS TO CIRCLE A NUMBER REPRESENTING THE MOST SUITABLE ANSWER ACCORDING TO THEM, IN THE FOLLOWING REPRESENTATION:

- 1 – STRONGLY DISAGREE
- 2 – DISAGREE
- 3 – NEITHER AGREE NOR DISAGREE
- 4 – AGREE
- 5 – STRONGLY AGREE

STATEMENT	S D	D	NA NOR ND	A	S A
Z SPORTS SHOES ARE VERY LIGHT WEIGHT	1	2	3	4	5
Z SPORTS SHOES ARE EXTREMELY COMFORTABLE	1	2	3	4	5
Z SPORTS SHOES LOOK TOO TRENDY	1	2	3	4	5
I WILL DEFINITELY RECOMMEND Z SPORTS SHOES	1	2	3	4	5

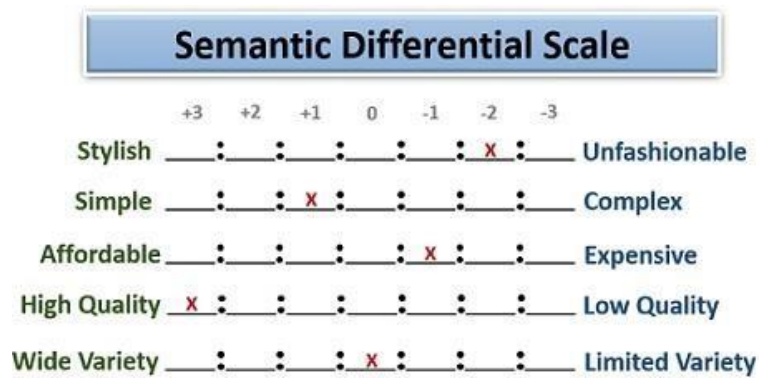
NOTE:

SD – STRONGLY DISAGREE D –  
DISAGREE  
NA NOR ND – NEITHER AGREE NOR NEITHER DISAGREE A –  
AGREE  
SA – STRONGLY AGREE

**G. SEMANTIC DIFFERENTIAL SCALE:** A BI-POLAR SEVEN-POINT NON-COMPARATIVE RATING SCALE IS WHERE THE RESPONDENT CAN MARK ON ANY OF THE SEVEN POINTS FOR EACH GIVEN ATTRIBUTE OF THE OBJECT AS PER PERSONAL CHOICE.

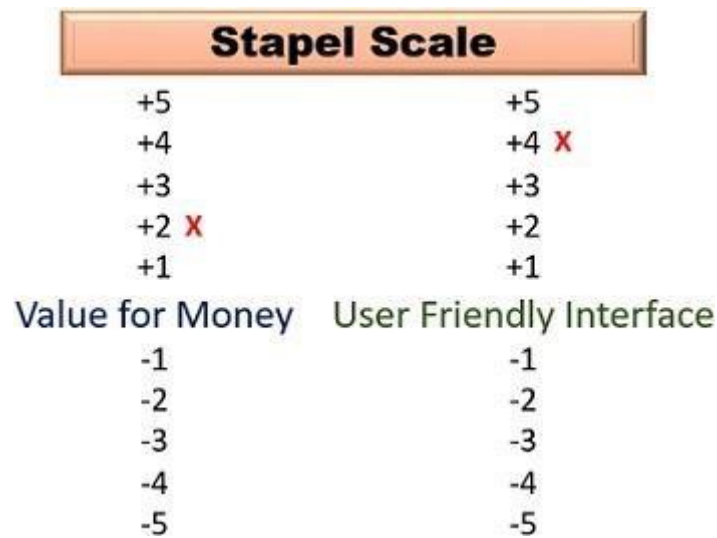
THUS, DEPICTING THE RESPONDENT’S ATTITUDE OR PERCEPTION TOWARDS THE OBJECT.

FOR EXAMPLE, A WELL-KNOWN BRAND FOR WATCHES, CARRIED OUT SEMANTIC DIFFERENTIAL SCALING TO UNDERSTAND THE CUSTOMER’S ATTITUDE TOWARDS ITS PRODUCT. THE PICTORIAL REPRESENTATION OF THIS TECHNIQUE IS AS FOLLOWS:



FROM THE ABOVE DIAGRAM, WE CAN ANALYZE THAT THE CUSTOMER FINDS THE PRODUCT OF SUPERIOR QUALITY; HOWEVER, THE BRAND NEEDS TO FOCUS MORE ON THE STYLING OF ITS WATCHES.

- **STAPEL SCALE:** A STAPEL SCALE IS THAT ITEMIZED RATING SCALE WHICH MEASURES THE RESPONSE, PERCEPTION OR ATTITUDE OF THE RESPONDENTS FOR A PARTICULAR OBJECT THROUGH A UNIPOLAR RATING. THE RANGE OF A STAPEL SCALE IS BETWEEN -5 TO +5 ELIMINATING 0, THUS CONFINING TO 10 UNITS. *FOR EXAMPLE, A TOURS AND TRAVEL COMPANY ASKED THE RESPONDENT TO RANK THEIR HOLIDAY PACKAGE IN TERMS OF VALUE FOR MONEY AND USER-FRIENDLY INTERFACE AS FOLLOWS:*



WITH THE HELP OF THE ABOVE SCALE, WE CAN SAY THAT THE COMPANY NEEDS TO IMPROVE ITS PACKAGE IN TERMS OF VALUE FOR MONEY. HOWEVER, THE DECISIVE POINT IS THAT THE INTERFACE IS QUITE USER-FRIENDLY FOR THE CUSTOMERS.

#### H. GUTTMAN SCALE:

A GUTTMAN SCALE (ALSO KNOWN AS CUMULATIVE SCALING OR SCALOGRAM ANALYSIS) IS AN ORDINAL SCALE TYPE WHERE STATEMENTS ARE ARRANGED IN A HIERARCHICAL ORDER SO THAT SOMEONE WHO AGREES WITH ONE ITEM WILL ALSO AGREE WITH LOWER-ORDER, EASIER, LESS EXTREME ITEMS. THESE STATEMENTS SHOULD REFLECT AN INCREASING INTENSITY OF ATTITUDE AND FORM A CONTINUUM THAT IS ACCEPTED BY THE RESPONDENTS. THE POINT AT WHICH THE RESPONDENT DISAGREES WITH A STATEMENT REFLECTS THE RESPONDENT'S SCALE POSITION.

A GUTTMAN SCALE PRESENTS A NUMBER OF ITEMS TO WHICH THE PERSON IS REQUESTED TO AGREE OR NOT AGREE. THIS IS TYPICALLY DONE IN A 'Yes/No' DICHOTOMOUS FORMAT. IT IS ALSO POSSIBLE TO USE A LIKERT SCALE, ALTHOUGH THIS IS LESS COMMONLY USED. GUTTMAN SCALES ARE VERY COMMONLY USED IN POLITICAL SCIENCE, ANTHROPOLOGY, PUBLIC OPINION, RESEARCH, AND PSYCHOLOGY.

#### ADVANTAGES:

- ❑ IT CAN BE USED TO ANSWER MANY QUESTIONS IN A SHORT AMOUNT OF SPACE AND/OR TIME.
- ❑ IT IS INTUITIVELY APPEALING TO MOST PEOPLE.
- ❑ IT PROVIDES RANKED DATA.
- ❑ REPRODUCIBILITY
- ❑ MORE ONE-DIMENSIONAL THAN LIKERT SCALING

### DISADVANTAGES:

- ❑ THE RANK ORDER OF THE STATEMENTS MAY NOT BE INTERPRETED IN THE SAME WAY BY THE RESEARCHER, THE SUBJECT OR BY INDEPENDENT JUDGES.
- ❑ DIFFICULT TO CONSTRUCT
- ❑ SCALOGRAM ANALYSIS MAY BE TOO RESTRICTIVE, ONLY A NARROW UNIVERSE OF CONTENT CAN BE USED
- ❑ CORNELL TECHNIQUE QUESTIONABLE
- ❑ RESULTS NO BETTER THAN SUMMATED LIKERT SCALES

### EXAMPLE

THE IDEAL GUTTMAN SCALE IS SUCH THAT IF THE RESPONDENT DISAGREES, FOR EXAMPLE, WITH STATEMENT 4 (HAVING AGREED WITH STATEMENTS 1 TO 3) THEN THE RESPONDENT WILL DISAGREE WITH STATEMENT 5 AND HIGHER AS THESE REPRESENT MORE EXTREME EXPRESSIONS OF THE ATTITUDE BEING INVESTIGATED.

FOR EXAMPLE, A SERIES OF ITEMS ON ATTITUDE COULD BE

"I AM WILLING TO BE NEAR A CAT"

"I AM WILLING TO HAVE A CAT" "I

LOVE TO HAVE A CAT"

"I AM WILLING TO TOUCH A CAT"

### PROCESSING OF DATA:

AFTER COLLECTING THE DATA, THE METHOD OF CONVERTING RAW DATA INTO MEANINGFUL INFORMATION IS CALLED AS PROCESSING OF DATA WHICH CONSISTS OF,

#### **1. EDITING OF DATA:**

EDITING IS VERY IMPORTANT SINCE DATA GATHERED DURING THE COLLECTION MAY LACK UNIFORMITY. DATA COLLECTED THROUGH A QUESTIONNAIRE AND SCHEDULES MAY HAVE ANSWERS WHICH MAY NOT BE TICKED AT PROPER PLACES. SOMETIMES DATA MAY BE GIVEN IN A FORM WHICH NEEDS RECONSTRUCTING, SAY CONVERTING DAILY INCOME INTO ANNUAL INCOME.

#### **2. CODING:**

CODING OF DATA MEANS TRANSLATING ANSWERS INTO NUMERIC VALUES. ASSIGNING NUMBERS TO THE VARIOUS CATEGORIES OF A VARIABLE TO BE USED IN DATA ANALYSIS.

#### **3. CLASSIFICATION:**

IT IS ALSO KNOWN AS DISTRIBUTION AND IT IS OF THE FOLLOWING TYPES,

##### **a. FREQUENCY DISTRIBUTION:**

IT PRESENTS THE FREQUENCY OF OCCURRENCES OF CERTAIN CATEGORIES.

**b. PERCENTAGE DISTRIBUTION:**

IT IS ALSO POSSIBLE TO GIVE FREQUENCIES NOT IN ABSOLUTE NUMBERS BUT IN PERCENTAGES. INSTEAD OF SAYING 200 RESPONDENTS OF TOTAL 2000 HAD A MONTHLY INCOME OF LESS THAN RS. 5.00 WE CAN SAY 10% OF RESPONDENTS HAVE A MONTHLY INCOME OF LESS THAN 500.

**c. CUMULATIVE DISTRIBUTION:**

IT TELLS HOW OFTEN A VALUE OF A RANDOM VARIABLE IS LESS THAN OR EQUAL TO A PARTICULAR REFERENCE VALUE.

**d. STATISTICAL DISTRIBUTION:**

SOME MEASURE OF AVERAGE IS FOUND OUT OF A SAMPLE OF RESPONDENTS. FOR VIZ, MEDIAN, MODE, MEAN.

**4. TABULATION:**

AFTER EDITING THE DATA, IT SHOULD PUT TOGETHER IN SOME KINDS OF TABLES.

**USES:**

- ☐ TABLES ARE VERY USEFUL AND THEY ARE VERY HELPFUL IN RESEARCH IN SO MANY WAYS;
- ☐ OVERALL VIEW OF FINDINGS IN A SIMPLER WAY.
- ☐ IDENTIFY THE TRENDS

**5. CHARTS:** DATA IS REPRESENTED IN PICTORIAL REPRESENTATION SUCH AS BAR CHARTS PIE CHARTS, CONE ETC. CHARTS ARE OFTEN USED TO EASE UNDERSTANDING OF LARGE QUANTITIES OF DATA AND RELATIONSHIP BETWEEN PARTS OF DATA.

**TYPES:**

- a. HISTOGRAM: CONSISTS OF TABULAR FREQUENCIES.
- b. BAR CHART: RECTANGULAR BARS WITH LENGTHS PROPORTIONAL TO VALUES.
- c. PIE CHART: PERCENTAGE VALUES AS A SLICE OF THE VALUES.

**REPORT WRITING:**

REPORT WRITING MAKES THE FINAL STAGE OF A RESEARCH STUDY. THE PURPOSE OF A REPORT WRITING IS TO TELL THE INTERESTED READERS THE PROBLEM INVESTIGATED, THE METHODS USED TO SOLVE THE PROBLEMS, THE RESULTS OF THE INVESTIGATIONS AND THE CONCLUSION INFERRED FROM THE RESULTS.

**PRECAUTIONARY MEASURES – PRESENTATION OF A REPORT:**

THE FOLLOWING PRECAUTIONARY MEASURES SHOULD BE TAKEN WHILE PRESENTING EFFECTIVE REPORT WRITING,

1. LENGTH OF THE REPORT SHOULD BE PRECISE AND SUFFICIENTLY LONG
2. THE REPORT SHOULD BE IN SUCH A MANNER TO CONVEY THE MATTER TO THE MAXIMUM EXTENT.

3. CARE MUST BE TAKEN TO VERIFY WHETHER THE VISUAL ILLUSTRATIONS, TABLES, CHARTS ARE PROPERLY INSERTED AT APPROPRIATE PLACES.
4. THE REPORT SHOULD BE IN LOGICAL ANALYSIS OF THE SUBJECT MATTER.

LAYOUT:

A COMPREHENSIVE LAYOUT SHOULD MAINLY CONSIST OF

A. PRELIMINARY PAGES:

- TITLE PAGE
- ACKNOWLEDGEMENT
- TABLE OF CONTENTS
- LIST OF TABLES
- LIST OF GRAPHS

B. MAIN TEXT:

- INTRODUCTION
- REVIEW OF RELATED LITERATURE
- DESIGN OF STUDY
- PRESENTATION & ANALYSIS OF DATA

C. END MATTER

- SUMMARY
- CONCLUSION
- BIBLIOGRAPHY

### NON PARAMETRIC TESTS:

IN STATISTICS, NONPARAMETRIC TESTS ARE METHODS OF STATISTICAL ANALYSIS THAT DO NOT REQUIRE A DISTRIBUTION TO MEET THE REQUIRED ASSUMPTIONS TO BE ANALYZED (ESPECIALLY IF THE DATA IS NOT NORMALLY DISTRIBUTED). DUE TO THIS REASON, THEY ARE SOMETIMES REFERRED TO AS DISTRIBUTION-FREE TESTS. NONPARAMETRIC TESTS SERVE AS AN ALTERNATIVE TO PARAMETRIC TESTS SUCH AS T-TEST OR ANOVA THAT CAN BE EMPLOYED ONLY IF THE UNDERLYING DATA SATISFIES CERTAIN CRITERIA AND ASSUMPTIONS.

NOTE THAT NONPARAMETRIC TESTS ARE USED AS AN ALTERNATIVE METHOD TO PARAMETRIC TESTS, NOT AS THEIR SUBSTITUTES. IN OTHER WORDS, IF THE DATA MEETS THE REQUIRED ASSUMPTIONS FOR PERFORMING THE PARAMETRIC TESTS, THE RELEVANT PARAMETRIC TEST MUST BE APPLIED.

IN ADDITION, IN SOME CASES, EVEN IF THE DATA DO NOT MEET THE NECESSARY ASSUMPTIONS BUT THE SAMPLE SIZE OF THE DATA IS LARGE ENOUGH, WE CAN STILL APPLY THE PARAMETRIC TESTS INSTEAD OF THE NONPARAMETRIC TESTS.

### REASONS TO USE NONPARAMETRIC TESTS

THE MAIN REASONS TO APPLY THE NONPARAMETRIC TEST INCLUDE THE FOLLOWING:

#### 1. THE UNDERLYING DATA DO NOT MEET THE ASSUMPTIONS ABOUT THE POPULATION SAMPLE

GENERALLY, THE APPLICATION OF PARAMETRIC TESTS REQUIRES VARIOUS ASSUMPTIONS TO BE SATISFIED. FOR EXAMPLE, THE DATA FOLLOWS A NORMAL DISTRIBUTION AND THE POPULATION VARIANCE IS HOMOGENEOUS. HOWEVER, SOME DATA SAMPLES MAY SHOW SKEWED DISTRIBUTIONS.

THE SKEWNESS MAKES THE PARAMETRIC TESTS LESS POWERFUL BECAUSE THE MEAN IS NO LONGER THE BEST MEASURE OF CENTRAL TENDENCY BECAUSE IT IS STRONGLY AFFECTED BY THE EXTREME VALUES. AT THE SAME TIME, NONPARAMETRIC TESTS WORK WELL WITH SKEWED DISTRIBUTIONS AND DISTRIBUTIONS THAT ARE BETTER REPRESENTED BY THE MEDIAN.

#### 2. THE POPULATION SAMPLE SIZE IS TOO SMALL

THE SAMPLE SIZE IS AN IMPORTANT ASSUMPTION IN SELECTING THE APPROPRIATE STATISTICAL METHOD. IF A SAMPLE SIZE IS REASONABLY LARGE, THE APPLICABLE PARAMETRIC TEST CAN BE USED. HOWEVER, IF A SAMPLE SIZE IS TOO SMALL, IT IS POSSIBLE THAT YOU MAY NOT BE ABLE TO VALIDATE THE DISTRIBUTION OF THE DATA. THUS, THE APPLICATION OF NONPARAMETRIC TESTS IS THE ONLY SUITABLE OPTION.

#### 3. THE ANALYZED DATA IS ORDINAL OR NOMINAL

UNLIKE PARAMETRIC TESTS THAT CAN WORK ONLY WITH CONTINUOUS DATA, NONPARAMETRIC TESTS CAN BE APPLIED TO OTHER DATA TYPES SUCH AS ORDINAL OR NOMINAL DATA. FOR SUCH TYPES OF VARIABLES, THE NONPARAMETRIC TESTS ARE THE ONLY APPROPRIATE SOLUTION.

### ASSUMPTIONS OF NON-PARAMETRIC TESTS:

CERTAIN ASSUMPTIONS ARE ASSOCIATED WITH MOST NON- PARAMETRIC STATISTICAL TESTS, NAMELY:

1. THAT THE OBSERVATIONS ARE INDEPENDENT;
2. THE VARIABLE UNDER STUDY HAS UNDERLYING CONTINUITY;
3. NON-PARAMETRIC PROCEDURES TEST DIFFERENT HYPOTHESIS ABOUT POPULATION THAN DO PARAMETRIC PROCEDURES;
4. UNLIKE PARAMETRIC TESTS, THERE ARE NON-PARAMETRIC TESTS THAT MAY BE APPLIED APPROPRIATELY TO DATA MEASURED IN AN ORDINAL SCALE, AND OTHERS TO DATA IN A NOMINAL OR CATEGORICAL SCALE.

#### ADVANTAGES OF NON-PARAMETRIC TESTS:

1. IF THE SAMPLE SIZE IS VERY SMALL, THERE MAY BE NO ALTERNATIVE TO USING A NON-PARAMETRIC STATISTICAL TEST UNLESS THE NATURE OF THE POPULATION DISTRIBUTION IS KNOWN EXACTLY.
2. NON-PARAMETRIC TESTS TYPICALLY MAKE FEWER ASSUMPTIONS ABOUT THE DATA AND MAY BE MORE RELEVANT TO A PARTICULAR SITUATION. IN ADDITION, THE HYPOTHESIS TESTED BY THE NON-PARAMETRIC TEST MAY BE MORE APPROPRIATE FOR THE RESEARCH INVESTIGATION.
3. NON-PARAMETRIC STATISTICAL TESTS ARE AVAILABLE TO ANALYZE DATA WHICH ARE INHERENTLY IN RANKS AS WELL AS DATA WHOSE SEEMINGLY NUMERICAL SCORES HAVE THE STRENGTH OF RANKS. THAT IS, THE RESEARCHER MAY ONLY BE ABLE TO SAY OF HIS OR HER SUBJECTS THAT ONE HAS MORE OR LESS OF THE CHARACTERISTIC THAN ANOTHER, WITHOUT BEING ABLE TO SAY HOW MUCH MORE OR LESS.
4. NON-PARAMETRIC METHODS ARE AVAILABLE TO TREAT DATA WHICH ARE SIMPLY CLASSIFICATORY OR CATEGORICAL, I.E., ARE MEASURED IN A NOMINAL SCALE. NO PARAMETRIC TECHNIQUE APPLIES TO SUCH DATA.
5. THERE ARE SUITABLE NON-PARAMETRIC STATISTICAL TESTS FOR TREATING SAMPLES MADE UP OF OBSERVATIONS FROM SEVERAL DIFFERENT POPULATIONS. PARAMETRIC TESTS OFTEN CANNOT HANDLE SUCH DATA WITHOUT REQUIRING US TO MAKE SEEMINGLY UNREALISTIC ASSUMPTIONS OR REQUIRING CUMBERSOME COMPUTATIONS.

#### DISADVANTAGES OF NON-PARAMETRIC TESTS:

1. IF ALL OF THE ASSUMPTIONS OF A PARAMETRIC STATISTICAL METHOD ARE, IN FACT, MET IN THE DATA AND THE RESEARCH HYPOTHESIS COULD BE TESTED WITH A PARAMETRIC TEST, THEN NON-PARAMETRIC STATISTICAL TESTS ARE WASTEFUL.
2. THE DEGREE OF WASTEFULNESS IS EXPRESSED BY THE POWER-EFFICIENCY OF THE NON-PARAMETRIC TEST.
3. ANOTHER OBJECTION TO NON-PARAMETRIC STATISTICAL TESTS IS THAT THEY ARE NOT SYSTEMATIC, WHEREAS PARAMETRIC STATISTICAL TESTS HAVE BEEN SYSTEMATIZED, AND DIFFERENT TESTS ARE SIMPLY VARIATIONS ON A CENTRAL THEME.
4. ANOTHER OBJECTION TO NON-PARAMETRIC STATISTICAL TESTS HAS TO DO WITH CONVENIENCE. TABLES NECESSARY TO IMPLEMENT NON-PARAMETRIC TESTS ARE SCATTERED WIDELY AND APPEAR IN DIFFERENT FORMATS.