

### 14.3.1 Types of estimates

We can make 2 types of estimate

1. Point estimate
2. Interval estimate

#### Point and interval estimation

##### *Point estimate*

It is used to estimate an unknown population parameter. Eg:-1 College principal might make a point estimate if he says "our present data indicates that biotechnology course will attract atleast 100 students. This a point estimate eg2- watch the first rainfall and conclude that we will have good rains this year.

The drawback of point estimate is that, it may be right or wrong. In the above example, of number of students who will enroll for a biotech course, we do not know how wrong is this estimate and we are not sure of estimate reliability. If we observe that estimate is off by 5 students, we call it a good estimate. If it is off by 40 students, we call it as a poor estimate. Therefore, it will be worthwhile that while making point estimate, the extent of error is also known.

##### *Internal estimate*

Here the error is indicated in 2 ways 1) The extent of its range 2) probability of the parameter lying within that range. In this case, the principal of the college might say like this "I estimate the number of students who will enroll to bio technology might fall between 80 to 120 and most likely, the exact number of students will lie within this interval.

##### *Point estimate*

Sample mean is the best estimator of population mean  $\mu$ . We can assume that sample is normally distributed. Eg: Let's look at a toffee company that produces toffee. A fixed no of toffee is filled into each pocket. But this packet is placed and jumble packed in a larger box. Because toffee is sold on a single packet basis, the retailer needs an estimate of the number of packets per carton for the purpose of making payments. Example below illustrates this.

Sample of 15 carton boxes with toffee packets

34	36	38	35	30
31	33	37	34	36
39	37	32	38	35

$$\bar{x} = \frac{525}{15} = 35$$

Therefore  $\bar{x}$  can be used as an estimator. Therefore population mean is 35 toffee packets per carton. The value of each toffee packet is so small say (2 to 3Rs) both the buyer and seller would accept the use of point estimate as the basis for payment and supplier can save time and cost.

### Interval estimate-concepts

Interval estimate describes range of value within which a population parameter is likely to lie.

Suppose the market research Manager needs an estimate in hours the average life of FSL lamp which the company manufactures. So a random sample 100 people who bought FSL lamp is listed. This can be got from the address and name mentioned on the bill. Interview these 100 people to share their experiences. Assume there 100 user has a mean lamp life 100 hours.

Market research manager knows that there is an element of uncertainty that will be there in estimate. To know this, standard error of the mean should be found. Assume that s.d of lamp is 20 using formula

$$S.E = \frac{s.d}{\sqrt{n}} = \frac{20}{\sqrt{100}} = \frac{20}{10} = 2$$

∴ Life could say between 98 and 102 hours

Probability of .955 means that sample size of 100 will be within  $\pm 2$  standard error of the population mean ie. 95.5 percent of all the sample means are within  $\pm 2$  standard error from  $\mu$ . Therefore  $\mu$  is within  $\pm 2$  standard error of 95.5 percent of all the sample means.

### Interval estimates and confidence intervals

Confidence level is the probability that we associate with an interval estimate. Higher probability means more confidence.

Confidence interval is the range of the estimate. We are making confidence interval is expressed in terms of standard error.

$$\bar{x} + 1.64 \frac{\sigma}{\sqrt{n}} \quad \text{U.L of confidence interval}$$

$$\bar{x} - 1.64 \frac{\sigma}{\sqrt{n}} \quad \text{L.L of confidence interval}$$

a) *Calculation of interval estimate of the mean from large samples (when sample S.D is known)*

Eg:- A bearing manufacturer needs an estimate of the mean life it can expect from an automotive bearing. Manufacturer has determined the standard deviation of the population life as 9 months surprising the researcher collects data from 100 bearings, the data will be follows.

Sample size=100

$\bar{x}$  sample mean =20

Sample standard deviation - 9 months

The dealer who stocks and sells bearing would like to find an interval estimate with a confidence level of 95 percent.

$$\therefore \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{9}{\sqrt{100}} = \frac{9}{10} = 0.9 \text{ -- Standard error of the mean}$$

Therefore confidence limits at 95% is  $\bar{x} + 1.96\sigma_{\bar{x}}$  - U.L.L

$$\bar{x} - 1.96\sigma_{\bar{x}} \text{ - L.C.L}$$

$$\begin{aligned} \bar{x} + 1.96\sigma_{\bar{x}} &= 20 + 1.96(0.9) \\ &= 20 + 1.464 \\ &= 21.464 \text{ months - U.L.L} \end{aligned}$$

$$\begin{aligned} \bar{x} - 1.96\sigma_{\bar{x}} &= 20 - 1.96(0.9) \\ &= 20 - 1.464 \\ &= 18.536 \text{ months - L.C.L} \end{aligned}$$

Therefore life of bearing will be between 18.536 and 21.464 months

b) *When population S.D is unknown*

Suppose tax authorities are interested in estimating the salary of 500 employees of a particular organisation. Let us assume the following

Sample size = 50

Sample mean = 10500 Rs.

Sample standard deviation = 900 Rs.

The interval estimate of 500 employee is to be calculated 90% confidence level is required where in population mean falls within the interval.

The difference in this problem is that, population standard deviation is not known. It is to be computed

$$\text{Population S.D. } \hat{\sigma} = S = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

$$\text{Standard error of the mean} = \hat{\sigma} = \frac{\sigma}{\sqrt{n}} \times \sqrt{\frac{N-n}{N-1}}$$

$$= \frac{900}{\sqrt{50}} \times \sqrt{\frac{500-50}{500-1}}$$

$$= \frac{900}{7.07} \times \sqrt{\frac{450}{499}}$$

120.7 = Estimate of standard error of the mean.

Now if we want 90% confidence level, this will include 45 percent of the area on either side of the mean.

$$\text{Confidant limits are } (\bar{x} \pm 1.64 \hat{\sigma})$$

$$\text{Upper confidence limit} = \bar{x} + 1.64 \hat{\sigma}$$

$$= 10500 + 1.64(120.7) = 1055 + 198$$

$$\text{Lower confidence limit} = 10500 - 1.64(120.7)$$

with 90% confidence level we can say that the salary of the employee falls between 10698 and 10302

### Calculating interval estimate of the proportion

Sometimes we need to estimate a portion of occurrences in a population. We use 2 formulas to find mean and standard deviation

$$\mu = np$$

$$\sigma = \sqrt{npq}$$

where n = number of samples

p = probability of success

$q=1-p$ - probability of failure

$$\text{standard error of the proportion } \frac{\sigma}{\hat{p}} = \sqrt{\frac{pq}{n}}$$

### When population portion is unknown

Suppose we want to know what portion of employees like to use company provided transport to commute from and to the place of work. Take random sample of 75 employees and assume 40% are interested in using the bus.

$n=75$ -sample

$p=40\%(0.4)$ -those who want to use the bus

$q=60\%(0.6)$ -those who do not want to use the bus.

We need to find an interval about which the managers is 99 percent confident that it contains true population proportion.

$$\begin{aligned} \text{Standard error of the proportion} &= \sigma_{\hat{p}} = \sqrt{\frac{pq}{n}} \\ &= \sqrt{\frac{0.4 \times 0.6}{75}} \\ &= \sqrt{0.0032} \\ &= 0.057 - \text{estimated S.E} \end{aligned}$$

At 99 per cent confidence level limits are  $p \pm 2.58 \frac{\sigma}{\hat{p}}$

$$\begin{aligned} p + 2.58 \frac{\sigma}{\hat{p}} &= 0.4 + 2.58(0.057) \\ &= 0.4 + 0.147 \\ &= 0.547 \end{aligned}$$

or

$$\begin{aligned} p - 2.58 \frac{\sigma}{\hat{p}} &= 0.4 - 2.58(0.057) \\ &= 0.4 - 0.147 \\ &= 0.253 \end{aligned}$$

Therefore we conclude that from our sample of 75 employees with 99 percent confidence level, we can say, that those who want to use the transport provided by the company lies between 0.253 and 0.547

### Interval estimate using t distribution

Size t distribution for estimating is required, whenever the sample is 30 or less, and population standard deviation is not known—further we assume that is using the t distribution, population is normal

*Degree of freedom:* Degree of freedom is nothing but the number of values that we can choose freely

Example  $\frac{x+y}{2} = 20$

How to find what values x and y can take. The answer is that x and y can take any values whose total is 40.

suppose x is 10 then y can take no other value, other than 30. the above example shows that, when there are 2 elements in a sample, we know the sample mean of these 2 elements we can freely specify the value of one of the elements because other element will be determined by the fact that that the 2 elements sum to twice the sample mean. There we call that degree of freedom is one.

Look at another example

$$\frac{x+y+z+t+u+v}{5} = 16$$

In this cause degree of freedom is 6-1=5 we can use degree of freedom who we select a t distribution to estimate a population mean and we use (n-1) degree of freedom, allowing n equal to sample size.

Like we have done earlier, estimate the S.E

$$\hat{\sigma}_x = \frac{\hat{\sigma}}{\sqrt{n}}$$

once  $\hat{\sigma}_x$  is estimates, decide the level of confidence for interval estimate -  $\left( \bar{x} \pm 2.262 \hat{\sigma}_x \right)$

## 14.4 INTERPRETATION OF COLLECTED DATA

Interpretation means bringing out the meaning of data. We can also say that interpretation is to convert data into information. The essence of any research is to do interpretation about the study. This requires a high degree of skill. There are two methods of drawing conclusions (1) induction (2) deduction.

In the induction method, one starts from observed data and then generalisation is done which explains the relationship between objects observed.

On the other hand, deductive reasoning starts from some general law and is then applied to a particular instance i.e., deduction comes from the general to a particular situation.

*Example of Induction:* All products manufactured by Sony are excellent. DVD player model 2602 MX is made by Sony. Therefore, it must be excellent.

*Example of Deduction:* All products have to reach decline stage one day and become obsolete. This radio is in decline mode. Therefore, it will become obsolete.

During the inductive phase, we reason from observation. During the deductive phase, we reason towards the observation. Both logic and observation are essential for interpretation.

Successful interpretation depends on how well the data is analysed. If data is not properly analysed, the interpretation may go wrong. If analysis has to be corrected, then data collection must be proper. Similarly, if the data collected is proper but analysed wrongly, then too the interpretation or conclusion will be wrong. Sometimes, even with the proper data and proper analysis, the data can still lead to wrong interpretation. Interpretation depends upon the experience of the researcher and methods used by him for interpretation.

*Example:* A detergent manufacturer is trying to decide which of the three sales promotion methods (discount, contest, buy one get one free) would be most effective in increasing the sales. Each sales promotion method is run at different times in different cities. The sales obtained by the different sale promotion methods is as follows.

### *Sales Impact of Different Sale Promotion Methods*

Sales Promotion Method	Sales Associated with Sales Promotion
1	2,000
2	3,500
3	2,510

The results may lead us to the conclusion that the second sales promotion method was the most effective in developing sales. This may be adopted nationally to promote the product. But one cannot say that the same method of sales promotion will be effective in each and every city under study.

***Precautions:***

- (1) Keep the main objective of research in mind.
- (2) Analysis of data should start from simpler and more fundamental aspects.
- (3) It should not be confusing.
- (4) The sample size should be adequate.
- (5) Take care before generalising of the sample studied.
- (6) Give due attention to significant questions.
- (7) Do not miss the significance of some answers, because they are found from very few respondents, such as “don’t know” or “can’t say”.

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**SUMMARY**

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Data when collected is raw in nature. When processed, it becomes information without data analysis, and interpretation, researcher cannot draw any conclusion. There are several steps in data processing such as editing, coding and tabulation. The main idea of editing is to eliminate errors. Editing can be done in the field or by sitting in the office. Coding is done to enter the data to the computer. In other words, coding speeds up tabulation. Tabulation refers to placing data into different categories. Tabulation may be one way, two way or cross tabulation. Several statistical tools such as mode, median, mean is used. Lastly interpretation of the data is required to bring out meaning or we can say data is converted into information. Interpretation can use either induction or deduction logic. While interpreting certain precautions are to be taken.

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**KEYWORDS**

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Editing	Coding
Tabulation	Field editing
Office editing	Mode
Median	Mean
Dispersion	

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**REVIEW QUESTIONS**

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1. What is data processing?



2. What are the steps in data processing?
3. What is editing?
4. What are the stages of editing?
5. What is coding? What are the guidelines to codify the data?
6. What is tabulation?
7. What are the different kinds of tabulation?
8. How to summarise & classify the collected data?
9. Explain the following:
  - a) Mode, b) Median, c) Mean
10. What is measure of dispersion?
11. Explain the following:
  - a) Mean Deviation
  - b) Variance & Standard deviation
  - c) Coefficient of variation
12. How to interpret the collected data?
13. Explain induction & Deduction with examples.
14. What are the precaution to be taken while interpreting Marketing research data.
15. Discuss sampling and non-sampling methods
16. What are sampling and non-sampling errors?
17. What is statistical estimates?
18. What are point and interval estimates?
19. How to calculate the interval estimate of the mean from large samples?
20. How to calculate the interval estimate of the proportion when
  - a) Population portion is unknown
  - b) Using T distribution

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### ASSIGNMENT-1

You have collected data on employees of a large organisation in a metro. You analyse the data by the type of work, education level, whether the employee belongs to an urban or rural area. The results are as below. How would you interpret them?

**Annual Employee Turnover\***

	Higher Education		Lower Education	
	Salaried monthly	Daily wage	Salaried monthly	Daily wage
Rural	6	14	18	18
Urban	10	12	19	20

\*Turnover per 1,000 employees

**ASSIGNMENT-2**

XYZ company is into pharmaceuticals to produce a medicine 'A', which is a pain reliever. A survey was conducted with doctors as sample and the following questions were asked.

"Would you recommend product 'A' to your patients when they suffer from pain"?

Yes \_\_\_\_\_ No \_\_\_\_\_

An analysis of the above showed that 75% of doctors surveyed said 'Yes', the rest said 'No'. From this survey, XYZ company made the following inference. "Three out of four doctors have recommended product 'A' for their patients, who suffer from pain".

1. Is the inference valid?
2. If not, how else will you confirm that three out of four doctors have recommended this?

**ASSIGNMENT-3**

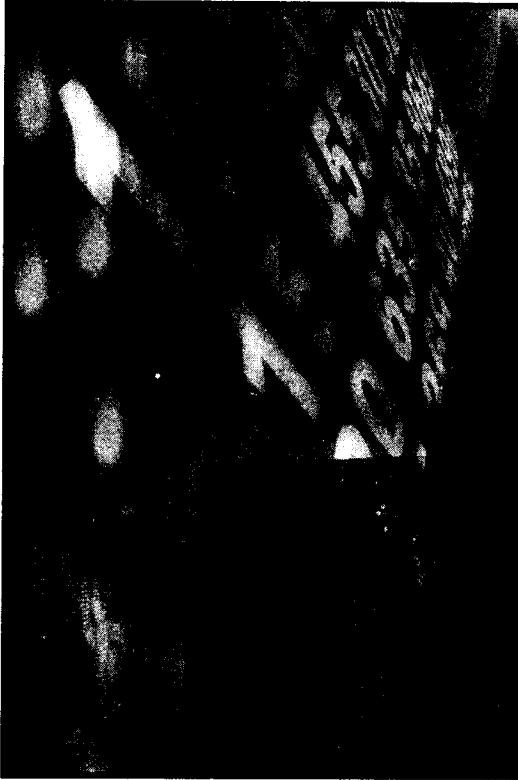
A highway petrol police on NH4 wants to find out how fast the car and truck travels on this highway stretch. To obtain this information, a speed recording device at an appropriate place on the highway was installed. The speed was recorded for about three hours and the following data was recorded.

**Speed in miles / hr.**

73	49	70	63
55	61	60	68
52	50	69	60
65	66	59	62

- Q. Calculate the appropriate statistics for central tendency and dispersion.

# Statistical Analysis of Business Research



**In this chapter, the following questions are discussed:**

- ❖ What is bivariate analysis?
- ❖ What is the Chi-Square test?
- ❖ What is multivariate analysis?
- ❖ What is correlation and regression analysis?
- ❖ What is ANOVA? How to use this technique in MR?
- ❖ Application of SPSS
- ❖ What is SWOT and Trend Analysis?

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## 15.1 BIVARIATE ANALYSIS

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Sometimes, the marketers will come across situations, which are complex involving two or more variables. Hence, bivariate analysis deals with this type of situation.

*Example:* Chi-Square is an example of bivariate analysis.

## 15.2 CHI-SQUARE TEST

With the help of this test, we will come to know whether two or more attributes are associated or not. How much the two attributes are related cannot be by Chi-Square test. Suppose, we have certain number of observations classified according to two attributes. We may like to know whether a newly introduced medicine is effective in the treatment of certain disease or not.

The number of automobile accidents per week in a certain city were as follows:

Months	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct
No. of accidents	12	8	20	2	14	10	15	6	9	4

Does the above data indicate that accident conditions were uniform during the 10- month period.

$$\text{Expected frequency} = 12+8+20+2+14+10+15+6+9+4 = \frac{100}{10} = 10$$

### Computation

*Null hypothesis:* The accident occurrence is uniform over a 10-week period.

Month	Observed No. of accidents	Expected No. of accidents	$O - E$	$(O - E)^2$	$\frac{(O - E)^2}{E}$
1	12	10	2	4	0.4
2	8	10	-2	4	0.4
3	20	10	10	100	10.0
4	2	10	-8	64	6.4
5	14	10	4	16	1.6
6	10	10	0	0	0.0
7	15	10	5	25	2.5
8	6	10	-4	16	1.6
9	9	10	-1	1	0.1
10	4	10	-6	36	3.6
	100	100	0		26.6

$$\therefore \chi^2 = \sum \frac{(O - E)^2}{E} = (26.6)$$

Where O is the observed frequency, E is the expected frequency.

$$D.F = 10 - 1 = 9$$

Table value at 5% for 9 degree of freedom = 16.91

Since calculated value = 26.6 greater than table value of 16.91, null hypothesis rejected at 5% level of significance.

*Conclusion:* The accident occurring are not uniform over a 10-week period.

## 15.3 MULTIVARIATE ANALYSIS

In multivariate analysis, the number of variables to be tackled are many.

*Example:* The demand for television sets may depend not only on price, but also on the income of households, advertising expenditure incurred by TV manufacturer and other similar factors. To solve this type of problem, multivariate analysis is required.

*Multiple-variate analysis:* This can be studied under:

- (1) Discriminant analysis
- (2) Factor analysis
- (3) Cluster analysis
- (4) Conjoint analysis
- (5) Multidimensional scaling.

### 15.3.1 Discriminant Analysis

In this analysis, two or more groups are compared. In the final analysis, we need to find out whether the groups differ one from another.

*Example:* Where discriminant analysis is used

1. Those who buy our brand and those who buy competitors' brand.
2. Good salesman, poor salesman, medium salesman.
3. Those who go to Food World to buy and those who buy in a Kirana shop.
4. Heavy user, medium user and light user of the product.

Suppose there is a comparison between the groups mentioned as above along with demographic and socio-economic factors, then discriminant analysis can be used. One way of doing this is to proceed and calculate the income, age, educational level, so that the profile of each group could be determined. Comparing the two groups based on one variable alone would be informative but it would not indicate the relative importance of each variable in distinguishing the groups. This is because several variables within the group will have some correlation which means that one variable is not independent of the other.

If we are interested in segmenting the market using income and education, we would be interested in the total effect of two variables in combinations, and not their effects separately. Further, we would be interested in determining which of the variables are more important or had a greater impact. To summarize, we can say, that Discriminant Analysis can be used

when we want to consider the variables simultaneously to take into account their interrelationship.

Like regression, the value of dependent variable is calculated by using the data of independent variable.

$$Z = b_1x_1 + b_2x_2 + b_3x_3 + \dots$$

Z = Discriminant score

$b_1$  = Discriminant weight for variable

x = Independent variable

As can be seen in the above, each independent variable is multiplied by its corresponding weightage.

This results in a single composite discriminant score for each individual. By taking the average of discriminant score of the individuals within a certain group, we create a group mean. This is known as centroid. If the analysis involves two groups, there are two centroids. This is very similar to multiple regression, except that different types of variables are involved.

**Application:** A company manufacturing FMCG products introduces a sales contest among its marketing executives to find out “How many distributors can be roped in to handle the company’s product”. Assume that this contest runs for three months. Each marketing executive is given target regarding number of new distributors and sales they can generate during the period. This target is fixed and based on the past sales achieved by them about which, the data is available in the company. It is also announced that marketing executives who add 15 or more distributors will be given a Maruti omni-van as prize. Those who generate between 5 and 10 distributors will be given a two-wheeler as the prize. Those who generate less than 5 distributors will get nothing. Now assume that 5 marketing executives won a Maruti van and 4 won a two-wheeler.

The company now wants to find out, “Which activities of the marketing executive made the difference in terms of winning a prize and not winning the prize”. One can proceed in a number of ways. The company could compare those who won the Maruti van against the others. Alternatively, the company might compare those who won, one of the two prizes against those who won nothing. It might compare each group against each of the other two.

Discriminant analysis will highlight the difference in activities performed by each group members to get the prize. The activity might include:

1. More number of calls made to the distributors.
2. More personal visits to the distributors with advance appointments.
3. Use of better convincing skills.

***Discriminant Analysis***

1. What variable discriminates various groups as above; the number of groups could be two or more. Dealing with more than two groups is called Multiple Discriminant Analysis (M.D.A).
2. Can discriminating variables be chosen to forecast the group to which the brand/person/place belong to?
3. Is it possible to estimate the size of different groups?

**SPSS Commands for Discriminate Analysis**

Input data has to be typed in an SPSS file.

1. Click on STATISTICS at the SPSS menu bar.
2. Click on CLASSIFY followed by DISCRIMINANT.
3. Dialogue box will appear. Select the GROUPING VARIABLE. This can be done by clicking on the right arrow to transfer them from the variable list on the left to the grouping variable box on the right.
4. Define the range of values by clicking on DEFINE RANGE. Enter Minimum and Maximum value then click CONTINUE.
5. Select all the independent variable for discriminant analysis from the variable list by clicking on the arrow that transfers them to box on the right.
6. Click on STATISTICS on the lower part of main dialogue box. This will open up a smaller dialogue box.
7. Click on CLASSIFY on the lower part of the main dialogue box select SUMMARY TABLE under the heading DISPLAY in a small dialogue box that appears.
8. Click OK to get the discriminant analysis output.

**15.3.2 Factor Analysis**

The main purpose of Factor Analysis is to group large set of variable factors into fewer factors. Each factor will account for one or more component. Each factor a combination of many variables. There are two most commonly employed factor analysis procedures. They are:

- (1) Principle component analysis
- (2) Common factor analysis.

When the objective is to summarise information from a large set of variables into fewer factors, principle component factor analysis is used. On the other hand, if the researcher wants to analyse the components of the main factor, common factor analysis is used.

*Example: Common factor* – Inconvenience inside a car. The components may be:

1. Leg room.
2. Seat arrangement.
3. Entering the rare seat.
4. Inadequate dickey space.
5. Door locking mechanism.

*Principle Component Factor Analysis:*

*Purposes:* Customer feedback about a two-wheeler manufactured by a company.

*Method:* The M.R manager prepares a questionnaire to study the customer feedback. The researcher has identified six variables or factors for this purpose. They are as follows:

1. Fuel efficiency (A)
2. Durability (Life) (B)
3. Comfort (C)
4. Spare parts availability (D)
5. Breakdown frequency (E)
6. Price (F)

The questionnaire may be administered to 5,000 respondents. The opinion of the customer is gathered. Let us allot points 1 to 10 for the variables factors A to F. 1 is the lowest and 10 is the highest. Let us assume that application of factor analysis has led to grouping the variables as follows:

A, B, D, E into factor – 1

F into Factor -2

C into Factor - 3

Factor - 1 can be termed as Technical factor;

Factor - 2 can be termed as Price factor;

Factor - 3 can be termed as Personal factor.

For future analysis, while conducting a study to obtain customers' opinion, three factors mentioned above would be sufficient. One basic purpose of using factor analysis is to reduce the number of independent variables in the study. By having too many independent variables, the M.R study will suffer from following disadvantages:

1. Time for data collection is very high due to several independent variables.
2. Expenditure increases due to the time factor.



3. Computation time is more, resulting in delay.
4. There may be redundant independent variables.

### 15.3.3 Cluster Analysis

Cluster Analysis is used:

1. To classify persons or objects into small number of clusters or group.
2. To identify specific customer segment for the company's brand.

Cluster Analysis is a technique used for classifying objects into groups. This can be used to sort data (a number of people, companies, cities, brands or any other objects) into homogeneous groups based on their characteristics.

The result of Cluster Analysis is a grouping of the data into groups called clusters. The researcher can analyse the clusters for their characteristics and give the cluster, names based on these.

Where can Cluster Analysis be applied?

The marketing application of cluster analysis is in customer segmentation and estimation of segment sizes. Industries, where this technique is useful include automobiles, retail stores, insurance, B-to-B, durables and packaged goods. Some of the well-known frameworks in consumer behaviour (like VALS) are based on value cluster analysis.

Cluster Analysis is applicable when:

- An FMCG company wants to map the profile of its target audience in terms of lifestyle, attitude and perceptions.
- A consumer durable company wants to know the features and services a consumer takes into account, when purchasing through catalogues.
- A housing finance corporation wants to identify and cluster the basic characteristics, lifestyles and mindset of persons who would be availing housing loans. Clustering can be done based on parameters such as interest rates, documentation, processing fee, number of installments etc.

#### *Process*

There are two ways in which Cluster Analysis can be carried out:

1. First, objects/respondents are segmented into a pre-decided number of clusters. In this case, a method called non-hierarchical method can be used, which partitions data into the specified number of clusters.
2. The second method is called the hierarchical method.

The above two are basic approaches used in cluster analysis. This can be used to segment customer groups for a brand or product category, or to segment retail stores into similar groups based on selected variables.

### *Interpretation of Results*

Ideally, the variables should be measured on an interval or ratio scale. This is because the clustering techniques use the distance measure to find the closest objects to group into a cluster. An example of its use can be clustering of towns similar to each other which will help decide where to locate new retail stores.

If clusters of customers are found based on their attitudes towards new products and interest in different kinds of activities, an estimate of the segment size for each segment of the population can be obtained, by looking at the number of objects in each cluster.

Names can also be given to clusters to describe each one. For example, there can be a cluster called “neo-rich”. Segments are prioritised based on their estimated size.

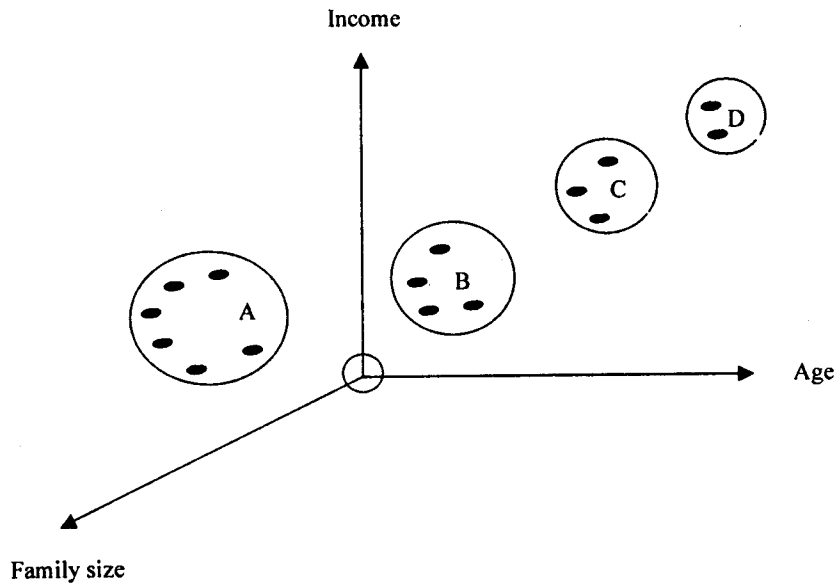
Marketing strategies for each segment are fine-tuned based on the segment characteristics. For instance, a segment of customers, like sports car, get a special promotional offer during specific period.

*Example:* In cluster analysis, the following five steps to be used:

- (1) Selection of the sample to be clustered (buyers, products, employees).
- (2) Definition on which the measurement to be made (Eg: product attributes, buyer characteristics, employees’ qualification).
- (3) Computing the similarities among the entities.
- (4) Arrange the cluster in a hierarchy.
- (5) Cluster comparison and validation.

### *Cluster Analysis on Three Dimensions*

The example below shows Cluster Analysis based on three dimensions age, income and family size. Cluster Analysis is used to segment the car-buying population in a Metro. For example “A” might represent potential buyers of low end cars. Example: Maruti 800 (for common man). These are people who are graduating from the two-wheeler market segment. Cluster “B” may represent mid-population segment buying Zen, Santro, Alto etc. Cluster “C” represents car buyers, who belong to upper strata of society. Buyers of Lancer, Honda city etc. Cluster “D” represents the super-rich cluster, i.e. Buyers of Benz, BMW etc.



**Matching Measure**

*Example:* Suppose there are five attributes, 1 to 5, on which we are judging two objects A and B. The existence of an attribute may be indicated by 1 and its absence by 0. In this way, two objects are viewed as similar if they share common attributes.

**Table**

Attribute	1	2	3	4	5	6	7
Brand - A	1	0	0	1	0	0	1
Brand - B	0	0	1	1	1	0	0

One measure of simple matching S is given by:

$$S = \frac{a + d}{a + b + c + d}$$

Where a = No. of attributes possessed by brands A and B

b = No. of attributes possessed by brand A but not by brand B

c = No. of attributes possessed by brand B but not by brand A

d = No. of attributes not possessed by both brands.

Substituting, we get  $S = \frac{1+2}{1+2+2+2} = \frac{3}{7} = 0.43$

A and B's association is to be the extent of 43%.

It is now clear that object A possess attributes 1, 4, and 7 while object B possess the attributes 3, 4 and 5. A glance at the above table will indicate that objects A and B are similar in respect of 2 (0 & 0), 6 (0 & 0) and 4 (1 & 1). In respect of other attributes, there is no similarity between A and B. Now we can arrive at a simple matching measure by (a) counting up the total number of matches – either 0, 0 or 1, (b) dividing this number by the total number of attributes.

Symbolically  $SAB = M / N$

SAB = Similarity between A and B

M = Number of attributes held in common (0 or 1)

N = Total number of attributes

$SAB = 3 / 7 = 0.43$

i.e., A & B are similar to the extent of 43%.

## SPSS Command for Cluster Analysis

### *Stage 1*

Enter the input data along with variable and value labels in an spss file

1. Click on STATISTICS at the spss menu bar.
2. Click on CLASSIFY followed by HIERACHICAL CLUSTER.
3. Dialogue box will appear select all the variables which are required to be used in cluster analysis. This can be done by clicking on the right arrow to transfer them from the variable list on the left.
4. Click on METHOD. The dialogue box will open. Choose “ Between Groups Linkage” as the CLUSTER METHOD.
5. Click CONTINUE to return to main dialogue box.
6. Click STATISTICS on the main dialogue box. Choose “ Agglomeration schedule” so that it will appear in the final output click CONTINUE.
7. Choose DENDROGRAM then on the box called ICICLE, Choose “ All Clusters” and “Vertical”.
8. Click OK on the main dialogue box to get the output of the hierarchical cluster analysis.

### *Stage 2*

This stage is used to know how many clusters are required. This stage is called K- MEANS CLUSTERING.

1. Click CLASSIFY, followed by K- FANS CLUSTER desired.
2. Fill in the desired number of clusters that has been identified from stage 1.
3. Click OPTIONS on the main dialogue box. Select “ Initial Cluster Centers”. Then click CONTINUE to return to the main dialogue box.
4. Click OK on the main dialogue box to get the output which has final clusters.

### 15.3.4 Conjoint Analysis

Conjoint analysis is concerned with the measurement of the joint effect of two or more attributes that are important from the customers' point of view. In a situation where the company would like to know the most desirable attributes or their combination for a new product or service, the use of conjoint analysis is most appropriate.

*Example:* An airline would like to know, which is the most desirable combination of attributes to a frequent traveller: (a) Punctuality (b) Air fare (c) Quality of food served on the flight and (d) Hospitality and empathy shown.

Conjoint Analysis is a multivariate technique that captures the exact levels of utility that an individual customer places on various attributes of the product offering. Conjoint Analysis enables a direct comparison,

*Example:* A comparison between the utility of a price level of Rs. 400 versus Rs. 500, a delivery period of 1 week versus 2 weeks, or an after-sales response of 24 hours versus 48 hours.

Once we know the utility levels for each attribute (and at individual levels as well), we can combine these to find the best combination of attributes that gives the customer the highest utility, the second best combination that gives the second highest utility, and so on. This information is then used to design a product or service offering.

#### Application

Conjoint Analysis is extremely versatile and the range of applications includes virtually in any industry. New product or service design, including the concepts in the pre-prototyping stage can specifically benefit from the conjoint applications.

Some examples of other areas where this technique can be used are:

- Designing an automobile loan or insurance plan in the insurance industry,
- Designing a complex machine for business customers.

**Process**

Design attributes for a product are first identified. For a shirt manufacturer, these could be design such as designer shirts Vs plain shirts, this price of Rs 400 versus Rs. 800. The outlets can have exclusive distribution or mass distribution. All possible combinations of these attribute levels are then listed out. Each design combination will be ranked by customers and used as input data for Conjoint Analysis. Then the utility of the products relative to price can be measured.

The output is a part-worth or utility for each level of each attribute. For *example*, the design may get a utility level of 5 and plain, 7.5. Similarly, the exclusive distribution may have a part utility of 2, and mass distribution, 5.8. We then put together the part utilities and come up with a total utility for any product combination we want to offer, and compare that with the maximum utility combination for this customer segment.

This process clarifies to the marketer about the product or service regarding the attributes that they should focus on in the design.

If a retail store finds that the height of a shelf is an important attribute for selling at a particular level, a well-designed shelf may result from this knowledge. Similarly, a designer of clocks will benefit from knowing the utility attached by customers to the dial size, background colours, and price range of the clocks.

**Approach**

From a discussion with the client, identify the design attributes to be studied and the levels at which they can be offered. Then build a list of product concepts on offer. These product concepts are then ranked by customers. Once this data is available, use Conjoint Analysis to derive the part utilities of each attribute level. This is then used to predict the best product design for the given customer segment. Use the SPSS Conjoint procedure to analyse the data.

There are three steps in **conjoint analysis**:

- (a) Identification of relevant products or service attributes.
- (b) Collection of data.
- (c) Estimation of worth for the attribute chosen.

For attributes selection, the market researcher can conduct interview with the customers directly.

Example of conjoint analysis for a **Laptop**:

For a laptop, consider 3 **attributes**:

Weight (3 Kg or 5 Kg)

Battery life (2 hours or 4 hours)

Brand name (Lenovo or Dell)

Task: Rank order the following combination of these characteristics:

1 = Most preferred, 8= Least preferred

Combination	Rank
3 Kg, 2 hours, Lenovo	4
5 Kg, 4 hours, Dell	5
5 Kg, 2 hours, Lenovo	8
3 Kg, 4 hours, Lenovo	3
3 Kg, 2 hours, Dell	2
5 Kg, 4 hours, Lenovo	7
5 Kg, 2 hours, Dell	6
3 Kg, 4 hours, Dell	1

One combination 3 kg, 4 hours, Dell clearly dominates and 5 kg, 2 hours, Lenovo is least preferred.

Let us now take the average rank for 3 kg option =  $4+3+2+1 / 4 = 2.5$

For 5 kg option average rank is  $5+8+7+6 / 4 = 6.5$

For 4 hour option  $5+3+7+1 / 4 = 4$

For 2 hour option  $4+8+2+6 / 4 = 5$

For Dell  $5+6+1+2 / 4 = 3.5$

For Lenovo 5.5

Looking at the difference in average ranks, the most important characteristic to this respondent is weight = 4, followed by brand name = 2 and battery life = 1.

### SPSS Command for conjoint analysis

SPSS commands for conjoint Analysis. A data file is to be created containing all possible attribute combination.

1. Ask each of the respondent to rank all the combination of attributes contained in the file. This is nomiculated at DATA FILE 1. All the rankings should be entered in another file called DATA FILE 2.
2. Now 2 files namely DATA FILE1 and DATA FILE 2 are created.
3. A third file called SYNTAX file is to be opened. By using the FILE, OPEN command followed by syntax.
4. Type the following – conjoint plan = DATA FILE 1 SAV/DATA' DATA FILE 2 SAV/ SCORES=SCORE 1 to Score number of ranking/ FACTOR VARI ( DISCRETE) /

PLOT ALL ( Here 25 is the possible combination of attributes). Score is the term used for rankings. The no of scores will be equal to number of rankings. We should use the word RANK in the syntax instead of scores if Rankings are contained in the data file.

5. Click RUN from the menu of the syntax file that was created click all in the menu which appears on the screen. If the syntax is correct, the output for conjoint will appear.

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## 15.4 CORRELATION

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When we are interested in measuring the degree of relationship between two variables, we use a concept of correlation. Correlation is a statistical technique used for measuring the relationship or interdependence of two or more variables. Whenever a correlation analysis is made, it is advisable to draw a graph of the two variables in question. Such a graph is known as scatter diagram, wherein the values of two variables are plotted. The usual method is to plot independent variable on the horizontal axis and the dependent variable on the vertical axis. A scatter diagram indicates, whether there is any movement in one variable results in the movement of other variables. In case of perfect correlation, the point will fall on a straight line in a diagonal form: If this straight line is rising on the right, the correlation is positive and if it is falling, the correlation is negative.

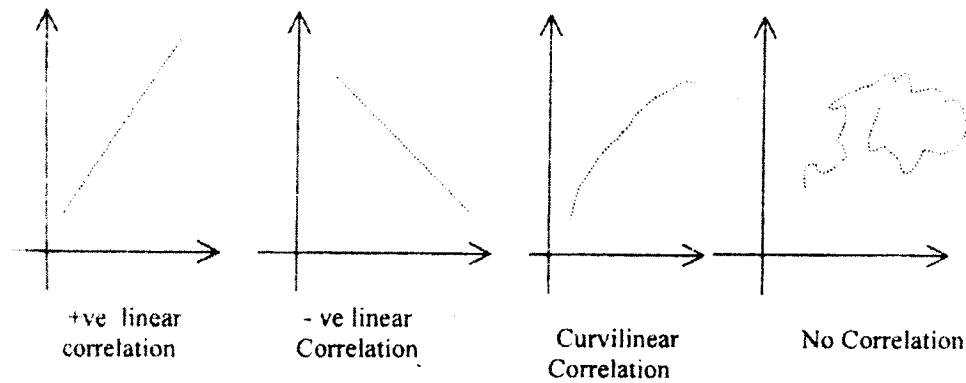
The researcher may want to dig deeper and find out how the advertising expenditure is correlated with other promotional expenditure. Or he may want to discover whether daily ice cream sales are correlated with the daily maximum temperature. Regression Analysis gives the answer.

How do the sales of a specific product, say Product 'A', correlate with promotional expenditure, advertising expenditure and the efficiency of the sales force? This vital information is what Regression Analysis delivers.

Correlation analysis measures the degree of association between two sets of quantitative data. Among correlated variables, if one variable can be predicted from others, like sales from advertising, distribution and number of sales personnel, we can build a regression model and fine-tune it for such predictions. For instance, monthly sales of a Pizza Corner may depend on the number of delivery boys, cost of advertising, the number of outlets, the variety of pizzas, the number of existing customers and the competitors' activities index.



## Scatter Diagrams



### 15.4.1 Coefficient of Correlation

Coefficient of correlation represents the degree of relationship between the two variables. It is denoted by the letter  $r$ .

*Example:* Coefficient of correlation value is 0.908. It means X and Y are related positively to the extent of 90.8%. Suppose  $r = 0$ , it means there is no correlation between X and Y. Coefficient of correlation indicates the casual relationship between tow attributes.

### 15.4.2 Canonical Correlation

Canonical correlation is defined as a correlation between the linear combination of dependent variable and linear combination of independent variable. This is an appropriate technique when the researcher has two dependent variables and multiple independent variables. The difference between multiple regression and canonical correlation analysis is that, in the former linear relationship between a single dependent variable and multiple independent variables are established.

*Application:* This technique is used to determine the relationship between multiple dependent and multiple independent variables.

*Example:* To study the relationship between factors describing the characteristics of a firm and the market captured. X below represents characteristics of the firm such as, (1) Technology (2) Trained manpower (3) High quality.

$$X = a_1p_1 + a_2p_2 + a_3p_3$$

Y represents the subject of interest namely market share, sales volume, brand image etc.

$$Y = b_1q_1 + b_2q_2 + b_3q_3$$

Thus the correlation between 'X' and 'Y' is defined as canonical correlation. For each variable, a weightage is attached.

### 15.4.3 Rank correlation

Sometimes, we are required to examine the extent of association between variables such as two rank ordering or two attributes. In such cases we need to use rank correlation. A measure of a certain degree of association between two variables X and Y, when the distribution is unknown is called as rank correlation coefficient. This was developed by Spearman. Therefore, this method is based on the ranks (or orders) of the observations, rather than on a specific distribution of X and Y. The formula to calculate rank correlation coefficient is.

$$r_s = 1 - \left( \frac{6 \sum d^2}{n(n^2 - 1)} \right)$$

Where N – Number of pairs of rank, d – difference between X and Y.

#### *Illustration*

Suppose an advertisement is inserted in the media. The cost of advertisement and sales obtained are tabulated as follows:

Advertisement cost (000) Rs.	39	65	62	90	82	75	25	98	36	78
Sales (lakhs)	47	53	58	86	62	68	60	91	51	84

Is there a correlation between advertisement expenditure and sales volume in monetary terms. If so, to what extent?

Calculation of rank correlation coefficient is as follows.

X	Y	Rank of X	Rank of Y	d = X-Y	d <sup>2</sup>
39	47	8	10	-2	4
65	53	6	8	-2	4
62	58	7	7	0	0
90	86	2	2	0	0
82	62	3	5	-2	4
75	68	5	4	1	1
25	60	10	6	4	16
98	91	1	1	0	0
36	51	9	9	0	0
78	84	4	3	1	1
				$\sum d=0$	$\sum d^2=30$

Apply the formula  $r_s = 1 - \left( \frac{6 \sum d^2}{n(n^2 - 1)} \right)$

$$r_s = 1 - \left( \frac{6 \times 30}{10(99)} \right)$$

$$r_s = 1 - \frac{180}{990}$$

$$r_s = 1 - \frac{2}{11}$$

$$r_s = \frac{9}{11} = 0.82$$

This shows a high degree of correlation between advertisement expenditure and sales.

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## 15.5 REGRESSION

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Regression is a technical term for predicting the value of one variable from the other. When we predict  $y$  from  $x$ , we use the equation  $y = (mx+c)$ . Here,  $m = r$  the coefficient of correlation. *Example:* If we know the temperature outside in degrees Centigrade, we can predict the temperature in Fahrenheit.

### How Regression Analysis Works

Sales forecasting is the most common application of regression analysis. We first identify a set of variables that affect sales, and that can be used to predict the same. For example, it could be macroeconomic variables such as housing sector, GDP growth rate and new automobile purchases, or marketing mix variables like advertising expense and number of sales or service people. Once these are identified, data on them is needed for at least twenty-five to thirty observations. We then build a linear equation using statistical methods like the least squares algorithm. We can also use some categorical predictor variables like the levels of education of consumers. Common applications include predicting sales of pizza, to the sales of cement and heavy machinery.

### Approach to Regression Analysis

If many variables exist, filter out some variables to reduce collinearity, or perform factor analysis to combine the correlated variables. Then a 'best prediction' equation is determined from the set of independent variables. The two criteria are – the statistical significance of the equation, and the amount of variance explained by all the variables included in the equation. SPSS is generally used to build the model.

### Method of Least Square

In many instances, the line may not pass through the points plotted in the scatter diagram. How can we fit a line mathematically if none of the points lie on the line. If the errors are minimized between the estimated points on the line and the actual observed points that were used to draw it. If these errors are minimized, then the line will have a good fit. To minimise the error, we need to calculate the slope and intercept (a) using the formula mentioned

$$\bar{x} = \frac{\sum x}{N}$$

$$\bar{y} = \frac{\sum y}{N}$$

### Regression Using Least Square Method

From the data given below:

- Find the two regression equations.
- Coefficient of correlation between marks in Economics and Statistics.
- Most likely marks in Statistics when the marks in Economics is 30.

Marks in Economics	26	28	35	32	31	36	29	38	34	32
Marks in Statistics	43	46	49	41	36	32	31	30	33	39

Ans: Let the Economics marks be denoted by X and the marks obtained in Statistics be variable Y. To calculate the regression, the equation is as follows:

$$\bar{x} = \frac{\sum x}{N} = \frac{320}{10} = 32$$

$$\bar{y} = \frac{\sum y}{N} = \frac{380}{10} = 38$$

X	Y	$X - \bar{x}$	$Y - \bar{y}$	$(X - \bar{x})^2$	$(Y - \bar{y})^2$	$(X - \bar{x})(Y - \bar{y})$
25	43	-7	5	49	25	-35
28	46	-4	8	16	64	-32
35	49	3	11	9	121	33
32	41	0	3	0	9	0
31	36	-1	-2	1	4	2
36	32	4	-6	16	36	-24
29	31	-3	-7	3	49	21
38	30	6	-8	36	64	-48
34	33	2	-5	4	25	-10
32	39	0	1	0	1	0

Coefficient of Regression of  $y$  on  $x$

$$b_{yx} = \frac{(X - \bar{x})(Y - \bar{y})}{\sum (X - \bar{x})^2}$$

$$b_{yx} = \frac{-93}{140} = -0.6643$$

Similarly, Regression coefficient of  $x$  on  $y$ :

$$b_{xy} = \frac{(X - \bar{x})(Y - \bar{y})}{\sum (Y - \bar{y})^2}$$

$$b_{xy} = \frac{-93}{398} = -0.2337$$

- (a) Regression equations are as follows:

Equation of line of regression  $x$  on  $y$

Equation of line of regression  $x$  on  $y$

$$(X - \bar{x}) = b_{xy} (Y - \bar{y})$$

$$X - 32 = -0.2337(y - 38)$$

$$= -0.2337y + 8.88$$

$$X = -0.2337y + 8.88 + 32$$

$$X = -0.2337Y + 40.88$$

Equation of the line of regression  $y$  on  $x$  is

$$(Y - \bar{y}) = b_{yx} (X - \bar{x})$$

$$Y - 3 = -0.664 (x - 32)$$

$$= -0.664x + 21.25$$

$$Y = -0.664x + 24.25$$

- (b) Correlation coefficient:

$$r^2 = b_{xy} \times b_{yx} = - (0.664) \times (-0.233) = .1552$$

$$r^2 = \pm \sqrt{0.1552} = \pm 0.394$$

Since both the regression coefficients are negative, or must be negative:

- (c) Most likely marks in statistics ( $Y$ ), when Economics ( $X$ ) is 30 use the equation of line of regression of  $Y$  on  $X$ .

$$X = -0.664 \times 30 + 24.25 = 3.32 \approx 3$$

## 15.6 ANALYSIS OF VARIANCE (ANOVA)

- (a) **ANOVA:** It is a statistical technique. It is used to test the equality of three or more sample means. Based on the means, inference is drawn whether samples belongs to same population or not.

(b) *Conditions for using ANOVA:*

- (1) Data should be quantitative in nature.
- (2) Data normally distributed.
- (3) Samples drawn from a population follows random variation.

(c) *ANOVA can be discussed in two parts :*

- (1) One-way classification
- (2) Two and three-way classification.

**15.6.1 One-way ANOVA**

Following are the steps followed in ANOVA:

- (a) Calculate the variance between samples.
- (b) Calculate the variance within samples.
- (c) Calculate F ratio using the formula.  

$$F = \text{Variance between the samples} / \text{Variance within the sample}$$
- (d) Compare the value of F obtained above in (c) with the critical value of F such as 5% level of significance for the applicable degree of freedom.
- (e) When the calculated value of F is less than the table value of F, the difference in sample means is not significant and a null hypothesis is accepted. On the other hand, when the calculated value of F is more than the critical value of F, the difference in sample means is considered as significant and the null hypothesis is rejected.

**Example**

ANOVA is useful.

- (1) To compare the mileage achieved by different brands of automotive fuel.
- (2) Compare the first year earnings of graduates of half a dozen top business schools.

**Application in Market Research**

Consider the following pricing experiment. Three prices are considered for a new toffee box introduced by Nutrine company. Price of three varieties of toffee boxes are Rs. 39, Rs. 44 and Rs. 49. The idea is to determine the influence of price levels on sales. Five supermarkets are selected to exhibit these toffee boxes. The sales are as follows:

Price (Rs.)	1	2	3	4	5	Total	Sample mean $\bar{x}$
39	8	12	10	9	11	50	10
44	7	10	6	8	9	40	8
49	4	8	7	9	7	35	7

What the manufacturer wants to know is: (1) Whether the difference among the means is significant? If the difference is not significant, then the sale must be due to chance. (2) Do the means differ? (3) Can we conclude that the three samples are drawn from the same population or not?

### 15.6.2 Two-way ANOVA

The procedure to be followed to calculate variance is the same as it is for the one-way classification. The example of two-way classification of ANOVA is as follows:

*Example:* A firm has four types of machines – A, B, C and D. It has put four of its workers on each machines for a specified period, say one week. At the end of one week, the average output of each worker on each type of machine was calculated. These data are given below:

	Average production by the type of machine			
	A	B	C	D
Worker 1	25	26	23	28
Worker 2	23	22	24	27
Worker 3	27	30	26	32
Worker 4	29	34	27	33

The firm is interested in knowing:

- Whether the mean productivity of workers is significantly different.
- Whether there is a significant difference in the mean productivity of different types of machines.

*Illustration:* Company 'X' wants its employees to undergo three different types of training programme with a view to obtain improved productivity from them. After the completion of the training programme, 16 new employees are assigned at random to three training methods and the production performance were recorded.

The training managers problem is to find out if there are any differences in the effectiveness of the training methods? The data recorded is as under:

#### Daily output of new employees

Method 1	15	18	19	22	11	
Method 2	22	27	18	21	17	
Method 3	18	24	19	16	22	15

Following steps are followed.

1. Calculate Sample mean i.e.  $\bar{x}$
2. Calculate General mean i.e.  $\bar{\bar{x}}$
3. Calculate variance between columns using the formula  $\sigma^2 = \frac{\sum n_i (x_i - \bar{\bar{x}})^2}{k-1}$   
where  $K = (n_1 + n_2 + n_3 - 3)$ .
4. Calculate sample variance. It is calculated using formula:  
Sample variance  $s_i^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$  where  $n$  is No. of observation under each method.
5. Calculate variance within columns using the formula  $\sigma^2 = \frac{\sum n_i - 1}{n_r - k}$
6. Calculate F using the ratio  $F = \left( \frac{\text{between column variance}}{\text{within column variance}} \right)$
7. Calculate the number of degree of freedom in the numerator F ratio using equation,  $d.f = (\text{No. of samples} - 1)$ .
8. Calculate the number of degree of freedom in the denominator of F ratio using the equation  $d.f = \sum (n_i - k)$
9. Refer to F table f8 find value.
10. Draw conclusions.

**Solution**

Method 1	Method 2	Method 3
15	22	24
18	27	19
19	18	16
22	21	22
11	17	15
		18
<b>85</b>	<b>105</b>	<b>114</b>

1. Sample mean is calculated as follows:

$$\bar{x}_1 = \frac{85}{5} = 17 \quad \bar{x}_2 = \frac{105}{5} = 21 \quad \bar{x}_3 = \frac{114}{6} = 19$$



## 2. Grand mean

$$\begin{aligned} \bar{x} &= \frac{15+18+19+22+11+22+27+18+21+17+24+19+16+22+15+18}{16} \\ &= \frac{304}{16} = 19 \end{aligned}$$

## 3. Calculate variance between columns:

$n$	$\bar{x}$	$\bar{x}$	$\bar{x} - \bar{x}$	$(\bar{x} - \bar{x})^2$	$n(\bar{x} - \bar{x})^2$
5	17	19	-2	4	$5 \times 4 = 20$
5	21	19	2	4	$5 \times 4 = 20$
6	19	19	0	0	$6 \times 0 = 0$
				$\sum n_i (\bar{x}_i - \bar{x})^2$	$= 40$

$$\sigma^2 = \frac{\sum n_i (\bar{x}_i - \bar{x})^2}{k-1} = \frac{40}{3-1} = 20$$

Variance between column = 20

## 4. Calculation sample variance:

Training method -1		Training method -2	Training method -3		
$x - \bar{x}$	$(x - \bar{x})^2$	$x - \bar{x}$	$(x - \bar{x})^2$	$x - \bar{x}$	
15-17	$(-2)^2 = 4$	22-21	$(1)^2 = 1$	18-19	$(1)^2 = 1$
18-17	$(1)^2 = 1$	27-21	$(6)^2 = 36$	24-19	$(5)^2 = 25$
19-17	$(2)^2 = 4$	18-21	$(-3)^2 = 9$	19-19	$(0)^2 = 0$
22-17	$(5)^2 = 25$	21-21	$(0)^2 = 1$	16-19	$(-3)^2 = 9$
11-17	$(-6)^2 = 36$	17-21	$(-4)^2 = 16$	22-19	$(3)^2 = 9$
				15-19	$(-4)^2 = 16$
$\sum (x - \bar{x})^2 = 70$		$\sum (x - \bar{x})^2 = 62$			$\sum (x - \bar{x})^2 = 60$

$$\begin{aligned} \text{Sample variance} &= \frac{\sum (x - \bar{x})^2}{n-1} = \frac{70}{5-1}, \quad \frac{\sum (x - \bar{x})^2}{n-1} = \frac{62}{5-1}, \quad \frac{\sum (x - \bar{x})^2}{n-1} = \frac{60}{6-1} \\ s_1^2 &= \frac{70}{4} = 17.5 \quad s_2^2 = \frac{62}{4} = 15.5 \quad s_3^2 = \frac{60}{5} = 12 \end{aligned}$$

$$\begin{aligned}
 5. \quad \text{Within column variance } \bar{\sigma}^2 &= \sum \left( \frac{n_i - 1}{n_1 - k} \right) s_i^2 \\
 &= \left( \frac{5-1}{16-3} \right) \times 17.5 + \left( \frac{5-1}{16-3} \right) \times 15.5 + \left( \frac{6-1}{16-3} \right) \times 12 \\
 &= \left( \frac{4}{13} \right) \times 17.5 + \left( \frac{4}{13} \right) \times 15.5 + \frac{5}{13} \times 12
 \end{aligned}$$

$$\text{Within column variance} = \frac{192}{13} = 14.76$$

6.  $F = \frac{\text{Between column variance}}{\text{Within column variance}} = \frac{20}{14.76} = 1.354$
7. d.f of Numerator =  $(3 - 1) = 2$ .
8. d.f of Denominator =  $\sum n_i - k = (5 - 1) + (5 - 1) + (6 - 1) = 16 - 3 = 13$ .
9. Refer to table using d.f = 2 and d.f = 13.
10. The value is 3.81. This is the upper limit of acceptance region. Since calculated value 1.354 lies within it we can accept  $H_0$ , the null hypothesis.

*Conclusion:* There is no significant difference in the effect of the three training methods.

### 15.6.3 Application of S.P.S.S

1. Open a new spread sheet (SPSS).
2. Enter the data in the first column grouped according to training method i.e. enter 15,18,19,22,11,22,27 and so on till 16 numbers are in the first 16 cells. Then, in the second column enter a '1' next to production performance figures of trainees, by method No.1. Enter a '2' next to production performance figures of trainees, by method No. 2.  
  
Finally enter a '3' next to product performance figures of trainees by method No. 3. This tells the computer which number belongs to the designated group. i.e. the '1' next to cells containing 15,18,19,22,11 indicates these numbers belong to first group, which in this case is method 1 of training programme. The same thing applies to '2' and '3'.

3. At the top of the first column double click on “var0001”. Under “Name” type “Method” in place of “var0001”. Then click on “var00002” and type Prod Perf.(cell limited to eight letters hence abbreviation). Then at the bottom of the spread sheet, click on “Data view” tab. This exercise will name the categories.
4. At the top of the spread sheet click on “Analyze”. Then click on “Compare Means” and “one-way ANOVA”. This commands indicate the statistical test to be run.
5. Using arrows shift “Prod Perf” over to “Dependent list” and shift training to “Factor”. This show that Prod Perf is the dependent variable and training is the independent variable to be examined.
6. Then click O.K.
7. The SPSS output will appear.

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## 15.7 SWOT ANALYSIS

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Everyday business faced with new challenges, strengths, weaknesses, opportunities and threats. The good thing is what happens to be a threat to the competitor could turn into a golden opportunity for you. All you need to do is keep your eyes open and take the right actions.

The SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis is a powerful technique to throw light on the business possibilities. SWOT Analysis helps to build strategies in a more streamlined manner and create a niche in the market.

### Strengths

- What do people in your market see as your strength?
- What advantages does your company have?
- How do you compare yourself with your competitors?
- What unique or low-cost resources do you have access to?

Look at the strengths in the context of competition. If you are comparing your product with a competitor who has a large share of the market, your owning large share of the market is not a strength, but a necessity.

### Weaknesses

- What should you avoid?
- How could you improve?
- What people in your market likely to see as your weaknesses?

You might need to get into your customers' or competitors' shoes to check if there are weaknesses that they perceive but you may have overlooked. It is more an internal versus an external view.

### Opportunities

- Where are the good opportunities your company could leverage?
- What are the interesting and promising trends you are aware of?

Opportunities could come your way through:

- Changes in the technology you use,
- Changes in the market,
- Changes in government policies that are relevant to your business,
- Changes in your target audience, such as lifestyles,
- Events in your industry.

You can discover new opportunities by analysing your strengths. You could also look at your weaknesses and think about the potential opportunities opening up if you eliminate your weaknesses.

### Threats

- What obstacles do you face?
- What is your competitor doing?
- Is changing technology threatening your position?
- Do you have bad debt or cash-flow problems?
- Could any of your weaknesses seriously threaten your business?
- Are the required specifications for your job, products or services changing?

Such an analysis will often throw light on the future course of action, both in terms of putting problems into perspective and pointing out what needs to be done.

Strengths and Weaknesses are internal, Opportunities and Threats relate to external factors.

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## 15.8 TREND ANALYSIS

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Data analysis including Trend Analysis is essential for a firm's competitive intelligence programme. The ability to accurately gauge customer response to changes in business and other environmental parameters is a powerful competitive advantage.

Trend Analysis, an essential part of running an organization's value chains and in acquiring and consolidating corporate success. It allows business users to make analytical decisions about what direction the business should target its resources on and to focus on those business processes that maximize revenue from core customers.

### What does Trend Analysis include?

1. **Trend Analysis:** Allows plotting aggregated response data over time. This is especially valuable, if we are conducting a long running survey and would like to measure differences in perception and responses over time. Thus, Trend Analysis provides an insight into the following:
  - ❖ Changes and trends in customer needs and behaviour, and shifts in the customers' perception of value
  - ❖ Trends in price change and cost drivers for the industry and/or specific segments
  - ❖ Change and evolution of the industry in terms of new entrants, and competition, threat of substitutes and relationship with buyers and suppliers
  - ❖ Upcoming business models and changing best practices of the industry and related emerging sectors
  - ❖ In-depth analysis of long-term industry, domestic and global economic cycles and trends.
2. **Market Basket Analysis:** Insight into services and product purchasing trend patterns.
3. **Market Segmentation:** Analyses common characteristics of a consumer base.
4. **Customer Churn:** Identifying those consumers who are most likely to discontinue that service or product.
5. **Fraud Detection:** Predetermining those transactions that are most likely to be fraudulent, taking into account previous trend analyses.
6. **Direct and Interactive (web-based) Marketing:** Predicting in advance the products or services a person is most likely to use based on past and present trends.

### Benefits:

1. **Detailed Trend Analysis:** Predicts the threat of new entrants and allows management to develop competitive strategies, thus enabling industry position as well as pursuit of leadership.
2. It provides security of strategic investments and protection of assets.
3. It enables crucial decisions on mergers and acquisitions as well as the ability to develop alliances and partner relationships.

4. Trend Analysis data can be further used for various cost/benefit analyses. It can also be extremely valuable as an early warning indicator of probable issues with product line and service level changes.
5. Trend Analysis enables a business to view strategies from a long-term perspective with respect to effective asset and investment deployment and can safeguard against costly errors in relationship management and strategic positioning.

***Advantage:***

1. The ability to accurately gauge customer response to changes in business and other environmental parameters has a powerful competitive advantage.
2. Internal and external users can apply Trend Analysis to determine weaknesses and strengths. This will enable internal users to enhance the administrative efficiency of the company when necessary, and external users to form valuation models of the company based on how well the company is managed.

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## 15.9 SPSS APPLICATION IN MR

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SPSS predictive analytics software is used to anticipate change. Over time, SPSS has become a leader in predictive analytics technologies by coupling commitment and innovation and also customer dedication. SPSS customers exist in almost every industry, from banking, insurance, finance, telecommunications, healthcare, manufacturing, consumer packaged goods, higher education, retail, government to market research. The SPSS software helps the organization to optimize interactions and relationships with the customers irrespective of their professional standing and ensures that the actions taken by them will positively bear fruit.

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### SUMMARY

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Chi square is used when there are 2 variables expected frequency and observed frequency is used for computing. Multivariate analysis is used if there are more than 2 variables. Some of the multi variate analysis are discriminant analysis, Factor analysis, Cluster analysis, conjoint analysis, and multi dimensional scaling. In discriminant analysis, it is verified whether the 2 groups differ from one another. Factor analysis is used to reduce large no of various factors into fewer variables cluster analysis is used to segmenting the market or to identify the target group.

Correlation is a statistical technique used to measure the relationship of 2 or more variables. The graph drawn by using 2 variables are called scatter diagram. The degree of

relationship between the 2 variables are called co-efficient of correlation. Cononomical correlation is defined as a correlation between the linear combination of dependent variable and linear combination of independent variable.

Regression is a term used for predicting the value of one variable from the other. Least square method is used to fit the line. Anova is used to draw inference, whether sample belong to same population or not. Anova can be oneway or two away.

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## KEYWORDS

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Chi square	Multivariate analysis
Discriminant analysis	Cluster analysis
Correlation	Regression analysis
Bivariate analysis	Anova
Least square method	Conjoint analysis
F-statistic	

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## REVIEW QUESTIONS

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1. What is Bivariate analysis?
2. Discuss chi square test with illustration.
3. Discuss discriminant analysis, its application and SPSS technique.
4. What is factor analysis?
5. What are the principal components of factor analysis?
6. What is cluster analysis?
7. Where can cluster analysis be applied?
8. What is three dimensional cluster analysis?
9. Write SPSS command for cluster analysis.
10. What is conjoint analysis?
11. Where conjoint analysis be applied.
12. Write SPSS command for conjoint analysis.
13. Explain the following with examples

240 ■ Business Research Methods

- a. Correlation
  - b. Co efficient of correlation
  - c. Rank correlation
14. Explain regression with example
  15. What is Anova
  16. What is one way Anova? How it is applied in market research.
  17. Discuss two way Anova with illustration.
  18. what is SWOT analysis? Make a SWOT analysis for a company you are familiar.
  19. What is trend analysis? Make a trend analysis for a company you are familiar.

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## ASSIGNMENT

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A marketing research agency collected the data and tabulated the frequency count between age and watching movies.

Visited movies	Under 40	Age more than 40	Total
Yes	42	71	113
No	51	65	116
Total	93	136	229

Q. What conclusion can be drawn from the above observation?



# Hypothesis Testing



**In this chapter, the following questions are discussed:**

- ❖ What are the steps involved in hypothesis testing?
- ❖ What are the errors in hypothesis testing?
- ❖ What are parametric tests?
- ❖ What are non-parametric tests?
- ❖ Application of S.P.S.S.

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## 16.1 WHAT IS HYPOTHESIS ?

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A hypothesis is a tentative proposition relating to certain phenomenon, which the researcher wants to verify when required.

If the researcher wants to infer something about the total population from which the sample was taken, statistical methods are used to make inference. We may say that, while a hypothesis is useful, it is not always necessary. Many a time, the researcher is interested in collecting and analysing the data indicating the main characteristics without a hypothesis.

Also, a hypothesis may be rejected but can never be accepted except tentatively. Further evidence may prove it wrong. It is wrong to conclude that since hypothesis was not rejected it can be accepted as valid.

What is a null hypothesis?

A null hypothesis is a statement about the population, whose credibility or validity the researcher wants to assess based on the sample.

A null hypothesis is formulated specifically to test for possible rejection or nullification. Hence the name 'null hypothesis'. Null hypothesis always states "no difference". It is this null hypothesis that is tested by the researcher.

### 16.1.1 Types of Hypothesis

There are several basis on which hypothesis are classified

- a. Descriptive Hypothesis
- b. Relation Hypothesis

#### Descriptive Hypothesis

These by name implies describing some characteristics of an object, a situation, an individual or even an organization

*Example:*

1. Students from autonomous institutions are placed faster than other institutions.
2. Research and practice of educations system in our country is not integrated.
3. Why youngster prefer "X" soft drinks?
4. Decentralization of decision making is more effective.

The above tells us the characteristics of some entity

#### Relational hypothesis

In this case we describe relationship between 2 variables

1. Why rich people shop at life style?
2. Rate of attrition is high in those Jobs where there is night shift working
3. More cohesive is the group, better is the output

*Working hypothesis:* This is a hypothesis framed in the early stages of research. These are altered or modified as investigation proceeds.

*Example:* As of now "demand and quality are related". Later on this may not be the fact as investigation proceeds.

4. **Null hypothesis:** this hypothesis states that there is no difference between the parameter and the statistic that is being compared.  
*Example:* There is no relationship between marks obtained in the examination and the success of the same student in the corporate world. Null hypothesis are framed for testing statistical significance. Null hypothesis is very exact.
5. **Analytical hypothesis:** Here relationship of analytical variable is found. These are used when one would like to specify the relationship between changes in one property leading to change in another.  
*Example:* Income level related to number of children in the family or literacy related to number of children in the family.
6. **Statistical hypothesis:** These are got from samples that are measurable. Statistical hypothesis are of 2 types
  - (a) **Hypothesis which indicates differences:**  
*Example:* there is a difference between the performance of students graduating from English medium schools and those of others.
  - (b) **Hypothesis which indicates association**  
*Example:* there is a perfect relationship between price and demand.
7. **Common Sense hypothesis:** There are based on what is being observed. 1) Junior students are more disciplined than seniors 2) Economically poor students work hard compared to those, who come from well to do families 3) Middle class families lead a humble living. The above are observed on a day to day basis over a period of time before drawing any conclusions.

### 16.1.2 Sources of Hypothesis

Hypothesis can be derived from many sources

1. **Theory:** Theory on the subject can act as a source of hypothesis. We start of from a general premise and then formulate hypothesis.  
*Example:* Providing employment opportunity is an indicator of social responsibility of a government enterprise. From the above several hypothesis, it can be deduced that:-
  - a) Public enterprise has greater social concern than other enterprises
  - b) Peoples perception of government enterprise is social concern.
  - c) Govt enterprise help in improving the life of less privileged people.

2. **Observation:** Peoples' behaviour is observed. In this method we use observed behaviour to infer the attitudes. This an indirect method of attitude measurement. Direct observation is used to get insights into research behaviour and other related issues.

*Example:* A shopper in a supermarket may be disguised, to watch the customer in the stores. The following may be observed. a) How the customer approaches the - Product category b) How long he/she spends in front of display. C) Whether the customer had difficulty in locating the product. Collect all these data and formulate a hypothesis regarding the behaviour of the customer towards the product.

3. **Past experience:** Here researcher goes by past experience to formulate the hypothesis  
*Eg:* A dealer may state that fastest moving kids apparel is frock. This may be verified.
4. **Case studies:** Case studies published can be used as a source for hypothesis. Normally this is done before the launch of a product to find customer taste and preferences
5. **Similarity:** this could be with respect to similarity in activities of human beings.

*Example:* Dress, food habits or any other activities found in human living in different parts of the globe.

### 16.1.3 Role of Hypothesis

1. Hypothesis helps to guide the investigator in the right direction.
2. What is to be studied is clear to the researcher through hypothesis.
3. The type of research be it exploratory, descriptive or causal is decided by the hypothesis.
4. Statistical techniques is determined.
5. hypothesis formulated and tested, if it is found to be true becomes a part of accepted theory.

### 16.1.4 Characteristics of a hypothesis

The following are the factors to be taken into account before judging whether hypothesis is good or not. Some of the characteristics of a hypothesis to be good are

1. Clarity of concepts
2. Whether possible to test or not?
3. Whether "what is to be tested is clear or not"?
4. Whether appropriate stastical techniques are available for testing?
5. Whether logical derivation is possible or not ?

6. Whether bias or subjectivity is eliminated or not. Objectivity should be the sole criteria?
7. Whether the hypothesis is simple or not?
8. Adequate theoretical backing is a prerequisite for hypothesis testing

1. **Clarity of concepts:** Concepts should not be abstract. If concepts are not clear, precise problem formulation will be difficult leading to difficulty in data collection. Concepts are important because, it means different to different people. The way concept is understood depends on the needs of a person.

*Example:* Wearing a sunglasses represents a life style for a student, whereas it is a eye protecting device to a doctor. Therefore different people hold different concepts about the same object. Concept can be classified as concrete concepts and abstract concepts. Concrete concepts are tangible things like chair or book. Abstracts concepts refers to characteristics of items such as attitude, motivation etc. concepts can also refer to different phenomenon.

*Example:* Same word may have several meaning. The researcher may use a word in one context but it may mean different to different people.

*Example:* "Dispose" to a researcher may mean "to give way", but other meanings are "to get rid of", "to sell", "to throw away". Sometimes researcher may use different words to describe the same phenomenon. Examples, "whole", "integral", "complete", "entire". Some concepts may not be measurable. Therefore concepts should be clear.

2. **Ability to test:** It should be possible to verify the hypothesis. Therefore a good hypothesis is one in which there is empirical evidence.

*Example:* "Children of rich parents do not do well in their studies"

"Most multinationals do not follow ethical codes" statement such as above, which are general in nature should be avoided.

3. **Specific / Clear:** What is to be tested should be clear. The relationship between the variables should clear or the statistic under verification should be mentioned clearly.

*Example:* Two wheeler manufactured by company "A" gives better milage than that manufactured by company "B". Here what is to be verified is clear and specific

4. **Statistical tools:** Hypothesis should be such that, it is possible to use statistical techniques. Such as Anova, Chi square, t test or other non parametric tests
5. **Logical:** If there is 2 or more Hypothesis derived from the same basic theory, they should not contradict each other.

*Example:* All objects dropped from a height come down. Stone is an object. Therefore when dropped from a height should come down.

*Example:* Man is mortal  
Raman is a man  
Therefore he is mortal

6. **Subjectivity:** Researchers subjectivity or his biased Judgement should be eliminated from the hypothesis.

*Example:* older sales man sells less than younger salesman. This may be a biased opinion. As a matter of fact, older salesman may be selling more due to their experience and rapport developed with the customer.

7. **Simple:** Hypothesis should be simple. Simple means less constraints or assumptions before formulating it.

*Example:* Our advertisement and our sales are related. Here the assumption made is that "No other factor other than our advertisement is responsible for our sales. In reality, the advertiser should know that competitors activity, which is beyond the control of the advertiser is assumed to be non existent. This may be done by the researcher to make the hypothesis simple. In reality it is not so.

8. **Theory:** Hypothesis must be supported or backed up by theoretical relevance.

*Example:* Attitude of customer towards a new product introduction. This study is very well backed up by theory on consumer behaviour.

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## 16.2 STEPS INVOLVED IN HYPOTHESIS TESTING

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1. Formulate the null hypothesis, with  $H_0$  and  $H_A$ , the alternate hypothesis.  
According to the given problem,  $H_0$  represents the value of some parameter of population.
2. Select on appropriate test assuming  $H_0$  to be true.
3. Calculate the value.
4. Select the level of significance other at 1% or 5%.
5. Find the critical region.
6. If the calculated value lies within the critical region, then reject  $H_0$ .
7. State the conclusion in writing.

### 16.2.1 Formulate the hypothesis:

The normal approach is to set two hypotheses instead of one, in such a way, that if one hypothesis is true, the other is false. Alternatively, if one hypothesis is false or rejected, then the other is true or accepted. These two hypotheses are:

- (1) Null hypothesis
- (2) Alternate hypothesis

Let us assume that the mean of the population is  $\mu_0$  and the mean of the sample is  $\bar{x}$ . Since we have assumed that the population has a mean of  $\mu_0$ , this is our null hypothesis. We write this as  $H_0: \mu = \mu_0$ , where  $H_0$  is the null hypothesis. Alternate hypothesis is  $H_A: \mu \neq \mu_0$ . The rejection of null hypothesis will show that the mean of the population is not  $\mu_0$ . This implies that alternate hypothesis is accepted.

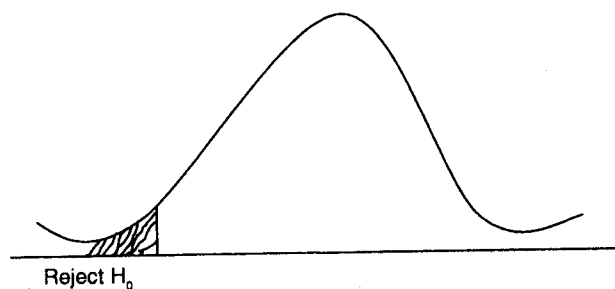
### 16.2.2 Significance Level

Having formulated the hypothesis, the next step is its validity at a certain level of significance. The confidence with which a null hypothesis is accepted or rejected depends upon the significance level. A significance level of say 5% means that the risk of making a wrong decision is 5%. The researcher is likely to be wrong in accepting false hypothesis or rejecting a true hypothesis by 5 out of 100 occasions. A significance level of say 1% means, that the researcher is running the risk of being wrong in accepting or rejecting the hypothesis is one of every 100 occasions. Therefore, a 1% significance level provides greater confidence to the decision than 5% significance level.

There are two type of tests.

### 16.2.3 One-tailed and two-tailed tests

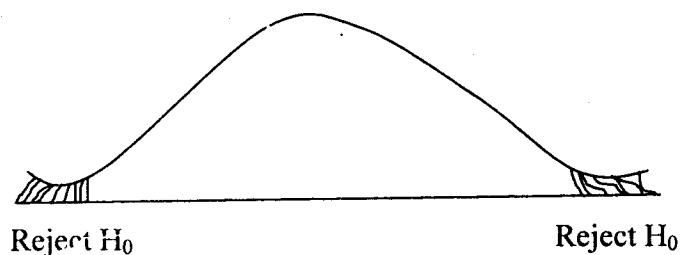
A hypothesis test may be one-tailed or two-tailed. In one-tailed test the test-statistic for rejection of null hypothesis falls only in one-tailed of sampling distribution curve.



*Example:* In a right side test, the critical region lies entirely in the right tail of the sample distribution. Whether the test is one-sided or two-sided – depends on alternate hypothesis.

*Example:* A tyre company claims that mean life of its new tyre is 15,000 km. Now the researcher formulates the hypothesis that tyre life is  $\neq$  15,000 km.

A two-tailed test is one in which the test statistics leading to rejection of null hypothesis falls on both tails of the sampling distribution curve as shown.



When we should apply a hypothesis test that is one-tailed or two-tailed depends on the nature of the problem. One-tailed test is used when the researcher's interest is primarily on one side of the issue. *Example:* "Is the current advertisement less effective than the proposed new advertisement"?

A two-tailed test is appropriate, when the researcher has no reason to focus on one side of the issue. *Example:* "Are the two markets – Mumbai and Delhi different to test market a product?"

*Example:* A product is manufactured by a semi-automatic machine. Now, assume that the same product is manufactured by the fully automatic machine. This will be two-sided test, because the null hypothesis is that "the two methods used for manufacturing the product do not differ significantly".

$$\therefore H_0 = \mu_1 = \mu_2$$

Sign of alternate hypothesis	Type of test
=	Two-sided
<	One-sided to right
>	One-sided to left

### 16.2.4 Degree of freedom

It tells the researcher the number of elements that can be chosen freely. *Example:*  $a+b/2 = 5$ . fix  $a=3$ ,  $b$  has to be 7. Therefore, the degree of freedom is 1.



### 16.2.5 Select test criteria

If the hypothesis pertains to a larger sample (30 or more), the Z-test is used. When the sample is small (less than 30), the T-test is used.

### 16.2.6 Compute

Carry out computation.

### 16.2.7 Make decisions

Accepting or rejecting of the null hypothesis depends on whether the computed value falls in the region of rejection at a given level of significance.

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## 16.3 ERRORS IN HYPOTHESIS TESTING

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There are two types of errors:

1. Hypothesis is rejected when it is true.
2. Hypothesis is not rejected when it is false.

(1) is called Type 1 error ( $\alpha$ ), (2) is called Type 2 error ( $\beta$ ). When  $\alpha = 0.10$  it means that true hypothesis will be accepted in 90 out of 100 occasions. Thus, there is a risk of rejecting a true hypothesis in 10 out of every 100 occasions. To reduce the risk, use  $\alpha = 0.01$  which implies that we are prepared to take a 1% risk i.e., the probability of rejecting a true hypothesis is 1%. It is also possible that in hypothesis testing, we may commit Type 2 error ( $\beta$ ) i.e., accepting a null hypothesis which is false. The only way to reduce Type 1 and Type 2 error is by increasing the sample size.

*Example of Type 1 and Type 2 error:*

Type 1 and Type 2 error is presented as follows. Suppose a marketing company has 2 distributors (retailers) with varying capabilities. On the basis of capabilities, the company has grouped them into two categories (1) Competent retailer (2) Incompetent retailer. Thus  $R_1$  is a competent retailer and  $R_2$  is an incompetent retailer. The firm wishes to award a performance bonus (as a part of trade promotion) to encourage good retailership. Assume that two actions  $A_1$  and  $A_2$  would represent whether the bonus or trade incentive is given and not given. This is shown as follows:

Action	(R1) Competent retailer	(R2) Incompetent retailer
A 1 performance bonus is awarded	Correct decision	Incorrect decision error ( $\beta$ )
A 2 performance bonus is not awarded	Incorrect decision error ( $\alpha$ )	Correct decision

When the firm has failed to reward a competent retailer, it has committed type-2 error. On the other hand, when it was rewarded to an incompetent retailer, it has committed type-1 error.

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## 16.4 TYPES OF TESTS

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1. Parametric test.
2. Non-parametric test.

### 16.4.1 Parametric test

1. Parametric tests are more powerful. The data in this test is derived from interval and ratio measurement.
2. In parametric tests, it is assumed that the data follows normal distributions. *Examples* of parametric tests are (a) Z-Test, (b) T-Test and (c) F-Test.
3. Observations must be independent i.e., selection of any one item should not affect the chances of selecting any others be included in the sample.

### 16.4.2 Non-parametric test

Non-parametric tests are used to test the hypothesis with nominal and ordinal data.

1. We do not make assumptions about the shape of population distribution.
2. These are distribution-free tests.
3. The hypothesis of non-parametric test is concerned with something other than the value of a population parameter.
4. Easy to compute. There are certain situations particularly in marketing research, where the assumptions of parametric tests are not valid. *Example:* In a parametric test, we assume that data collected follows a normal distribution. In such cases, non-parametric tests are used. Example of non-parametric tests are (a) Binomial test (b) Chi-Square test (c) Mann-Whitney U test (d) Sign test. A binomial test is used when the population has only two classes such as male, female; buyers, non-buyers, success, failure etc. All observations made about the population must fall into one of the two tests. The binomial test is used when the sample size is small.

### 16.4.3 Advantages

1. They are quick and easy to use.
2. When data are not very accurate, these tests produce fairly good results.

### 16.4.4 Disadvantages

Non-parametric test involves the greater risk of accepting a false hypothesis and thus committing a Type 2 error.

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## 16.5 UNIVARIATE / BIVARIATE DATA ANALYSIS

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### Univariate

If we wish to analyse one variable at a time, this is called univariate analysis. *Example:* Effect of sales on pricing. Here, price is an independent variable and sales is a dependent variable. Change the price and measure the sales.

### Bivariate

The relationship of two variables at a time is examined by means of bivariate data analysis.

If one is interested in a problem of detecting whether a parameter has either increased or decreased, a two-sided test is appropriate.

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## 16.6 TYPES OF PARAMETRIC TESTS

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### 16.6.1 Z test (Parametric test):

- a) When sample size is  $> 30$
- $P_1$  = Proportion in sample 1
- $P_2$  = Proportion in sample 2

*Example:* You are working as a purchase manager for a company. The following information has been supplied by two scooter tyres manufacturers.

	Company A	Company B
Mean life (in km)	13000	12000
S.D (in km)	340	388
Sample size	100	100

In the above, the sample size is 100, hence a Z-test may be used.

- b) Testing the hypothesis about difference between two means: This can be used when two population means are given and null hypothesis is  $H_0 : P_1 = P_2$ .

### **Illustration**

In a city during the year 2000, 20% of households indicated that they read 'Femina' magazine. Three years later, the publisher had reasons to believe that circulation has gone up. A survey was conducted to confirm this. A sample of 1,000 respondents were contacted and it was found 210 respondents confirmed that they subscribe to the periodical 'Femina'. From the above, can we conclude that there is a significant increase in the circulation of 'Femina'?

### **Solution:**

We will set up null hypothesis and alternate hypothesis as follows:

Null Hypothesis is  $H_0 : \mu = 15\%$

Alternate Hypothesis is  $H_A : \mu > 15\%$

This is a one-tailed (right) test.

$$Z = \frac{P - \mu}{\sqrt{\frac{\mu(1-\mu)}{n}}}$$

$$Z = \frac{\frac{210}{1000} - 0.20}{\sqrt{\frac{0.20(1-0.20)}{1000}}}$$

$$Z = \frac{0.21 - 0.20}{\sqrt{\frac{0.2 \times 0.8}{1000}}}$$

$$= \frac{0.01 - \mu}{\sqrt{\frac{0.16}{1000}}}$$

$$= \frac{0.1}{\frac{0.4}{31.62}}$$

$$= \frac{0.1}{0.012} = 8.33$$

As the value of Z at 0.05 = 1.64 and calculated value of Z falls in the rejection region, we reject null hypothesis, and therefore we conclude that the sale of 'Femina' has increased significantly.

### 16.6.2 T-test (Parametric test)

T-test is used in the following circumstances: When the sample size  $n < 30$ .

**Example:** A certain pesticide is packed into bags by a machine. A random sample of 10 bags are drawn and their contents are found as follows: 50, 49, 52, 44, 45, 48, 46, 45, 49, 45. Confirm whether the average packaging can be taken to be 50 kgs.

In this text, the sample size is less than 30. Standard deviations are not known using this test. We can find out if there is any significant difference between the two means i.e. whether the two population means are equal.

**Illustration:** There are two nourishment programmes 'A' and 'B'. Two groups of children are subjected to this. Their weight is measured after six months. The first group of children subjected to the programme 'A' weighed 44, 37, 48, 60, 41 kgs. at the end of programme. The second group of children were subjected to nourishment programme 'B' and their weight was 42, 42, 58, 64, 64, 67, 62 kgs. at the end of the programme. From the above, can we conclude that nourishment programme 'B' increased the weight of the children significantly, given a 5% level of confidence.

**Null Hypothesis:** There is no significant difference between Nourishment programme 'A' and 'B'.

**Alternative Hypothesis:** Nourishment programme B is better than 'A' or Nourishment programme 'B' increase the children's weight significantly.

**Solution:**

X	Nourishment programme A		y	Nourishment programme B	
	$x - \bar{x}$ = (x-46)	$(x - \bar{x})^2$		$y - \bar{y}$ = (y-57)	$(y - \bar{y})^2$
44	-2	4	42	-15	225
37	-9	81	42	-15	225
48	2	4	58	1	1
60	14	196	64	7	49
41	-5	25	64	7	49
			67	10	100
			62	5	25
<b>230</b>	<b>0</b>	<b>310</b>	<b>399</b>	<b>0</b>	<b>674</b>

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{s^2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

$$\text{Here } n_1 = 5 \quad n_2 = 7$$

$$\sum x = 230 \quad \sum y = 399$$

$$\sum (x - \bar{x})^2 = 310 \quad \sum (y - \bar{y})^2 = 674$$

$$\bar{x} = \frac{\sum x}{n_1} = \frac{230}{5} = 46$$

$$\bar{y} = \frac{\sum y}{n_2} = \frac{399}{7} = 57$$

$$s^2 = \frac{1}{n_1 + n_2 - 2} \left\{ \sum (x - \bar{x})^2 + \sum (y - \bar{y})^2 \right\}$$

$$\text{D.F} = (n_1 + n_2 - 2) = (5 + 7 - 2) = 10$$

$$s^2 = \frac{1}{10} \{310 + 674\} = 98.4$$

$$\begin{aligned} t &= \frac{46 - 57}{\sqrt{98.4 \times \left( \frac{1}{5} + \frac{1}{7} \right)}} \\ &= \frac{-11}{\sqrt{98.4 \times \left( \frac{12}{35} \right)}} \\ &= \frac{-11}{\sqrt{33.73}} = -\frac{11}{5.8} \\ &= -1.89 \end{aligned}$$

t at 10 d.f. at 5% level is 1.81.

Since, calculated  $t$  is greater than 1.81, it is significant. Hence  $H_A$  is accepted. Therefore the two nutrition programmes differ significantly with respect to weight increase.

### Application of SPSS

1. Open a new spread sheet. Enter the weight of children in first column. First, enter the weight of children in Group "A" in the first five cells and then the weight of children in Group "B" in the next 7 cells.
2. In the second column, type a "1" next to each weight of children in group 'A'. Type a '2' next to each weight of children in Group 'B'.
3. Highlight the heading "Analyse" and go to "Compare means". Then click on "Independent sample T-test".
4. Under "Grouping variable" click "Define groups". For "Group 1" type "1" and for "Group 2" type "2". This will indicate the Groups (A and B) weights of the 2 groups will be compared.

Click on "Continue" and "OK". The output will appear on the screen.

## 16.7 TYPES OF NON-PARAMETRIC TESTS

### 16.7.1 Chi-Square test: It is used in the following circumstances:

It is used in the following circumstances:

- a. Sample observations should be independent. i.e. two individual items should be included twice in a sample.
- b. The sample should contain at least 50 observations

Or

Total frequency should be greater than 50.

- c. There should be a minimum of five observations in any cell. This is called cell frequency constraint.

*Example:* Chi-Square

Persons	Age Group				Total
	Under 20-40	20-40	41-50	51 & Over	
Liked the car	146	78	48	28	300
Disliked the car	54	52	32	62	200
Total	200	130	80	90	500

Is there any significant difference between the age group and preference for the car?

### *Illustration*

A company marketing tea claims that 70% of population in a metro drink a particular brand (Wood Smoke) of tea. A competing brand challenged this claim. They took a random sample of 200 families to gather data. During the study period, it was found that 130 families were using this brand of tea. Will it be correct on the part of competitor to conclude that the claim made by the company does not holds good at 5% level of significance?

### *Hypothesis*

$H_0$  - People who drink Wood Smoke brand is 70%.

$H_1$  - People who drink Wood Smoke brand is not 70%.

If the hypothesis is true then number of consumers who drink this particular brand is  $200 \times 0.7 = 140$ .

Those who do not drink that brand are  $200 \times 0.3 = 60$

Degree of freedom =  $D = 2 - 1 = 1$ , since there are two groups.

Group	Observed (O)	Expected (E)	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E
Those who drink branded tea	130	140	-10	100	0.714
Those who did not drink branded tea	70	60	+10	100	1.667
	<b>200</b>	<b>200</b>	<b>0</b>		

$$\chi^2 = \frac{(O - E)^2}{E} = 2.381$$

A 0.5 level of significance of  $\chi^2$  for 1 d.f is equal to 3.841 (From tables). The calculated value is 2.381 is lower. Therefore, we accept the hypothesis that 70% of the people in that metro drink Wood Smoke branded tea.

### **Application of SPSS**

1. Open a new spread sheet.
2. Type the observed value in the appropriate cell of the first column. i.e. type "1" as it represents the branded tea drinkers 1-130 and "2" representing those who do not drink branded tea 131-200.
3. Using the heading on the page click "Analyse".



4. Using the subheading under "Analyse", click on "Non-parametric Tests" and then "Chi-Square".
5. Under the heading "Expected values", click on "Values" and type "140" and then click "add". Repeat this for "60" too.
6. Click on "OK".
7. Now you will receive output on the screen.

### Cox and Stuart test

This test is used to examine the presence of trends. A set of numbers is said to show upward trend if the latter numbers in the sequence are greater than the former numbers. And similarly, one can define a downward trend. How to examine whether a trend is noticeable in a sequence? *Example:* Suppose a marketer wants to examine whether its sales are showing a trend or just fluctuating randomly. Suppose the company has gathered the monthly sales figures during the past one year month-wise:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Sales	200	250	280	300	320	278	349	268	240	318	220	380

From the given data, analyse the sales trend.

### 16.7.2 Mann Whitney "U" test

(Rank Sum test)

This test is used to determine whether two independent samples have been drawn from the same population. Suppose an experiment has obtained two sets of samples from two populations and the study wishes to examine whether the two populations are identical.

*Example:* A computer company XYZ would like to choose the performance of programmers, working in 2 branches, located in different cities. The performance indices of employees:

Branch – A	Branch – B
84	76
68	77
78	64
49	62
45	53

To find out whether there is any difference in the performance indices of employees of the two branches.

### 16.7.3 Rank Sum test: (Kruskal-Wallis test)

We can use the Mann Whitney test; when two populations are involved, the Kruskal-Wallis test is used, when more than two populations are involved. This test will enable us to know whether independent samples have been drawn from the same population or from different populations having the same distribution. This test is an extension of "Mann Whitney test".

This is a type of Rank Sum test. This test is used to find out whether two or more independent samples are drawn from an identical population. This test is also called the H Test. Mann Whitney test is used when only two populations are involved and Kruskal-Wallis test is used when more than two populations are involved.

*Example:* In an assembling unit, three different workers do assembly work in shifts. The data is tabulated as follows:

Shift No.	Worker-1	Worker-2	Worker-3
1	25	28	29
2	31	28	30
3	35	29	27
4	33	28	36
5	35	32	31
6	31	32	34

Check whether there is any difference in the production quantum of the three workers:

*Illustration: (Kruskal-Wallis Test, H-Test)*

Let us assume that there are three categories of workers involved in a building construction. The wages depends on the skills possessed by them and their availability. The wages of three categories, namely painter carpenter and plumber are as follows:

Item	Sample 1 Dialy wages (Painter Rs.)	Sample 2 Dialy wages (Carpenter Rs.)	Sample 3 Dialy wages (Plumber Rs.)
1	64	72	51
2	66	74	52
3	72	75	54
4	74	78	56
5		80	

Use H-test and state whether the three populations are same or different.

$H_0$  - The wages of the three occupation are the same.

$H_1$  - The wages of the three occupations is not the same.

Item	Wage-Painter Rs./day		Wage-Carpenter Rs./day		Wage-Plumber Rs./day	
	Rs	Rank	Rs	Rank	Rs	Rank
1	64	5	72	7.5	51	1
2	66	6	74	9.5	52	2
3	72	7.5	75	11	54	3
4	74	9.5	78	12	56	4
5			80	13		
Total	276	$R_1=28$	379	$R_2=53$	213	$R_3=10$

$$n_1 = 4 \quad n_2 = 5 \quad n_3 = 4$$

$$n = n_1 + n_2 + n_3 = 4 + 5 + 4 = 13$$

$$R_1 = 28 \quad R_2 = 53 \quad R_3 = 10$$

$$H = \frac{12}{n(n+1)} \sum \left[ \frac{R_i^2}{n_i} \right] - 3(n+1),$$

$$H = \frac{12}{13(13+1)} \sum \left[ \frac{28^2}{4} + \frac{53^2}{5} + \frac{10^2}{4} \right] - 3(3+1) = 9.61$$

At 5% level of significance, for d.f = (3-1)=2, the table value is 5.991. Computed value 9.61 is greater.

**Conclusion:** Reject the Null hypothesis that the three populations are different.

### Application of SPSS

1. Open a new spread sheet.
2. Type the first group of numbers in the first column and the second group of numbers in the second column.
3. Using the headings of the page and click "Analyse".
4. Click on "Non parametric Tests" and then click on "2" related sample test.
5. Add "Test type" click on "Kruskal".
6. Then shift "var0001" "and var0002" over to "Test pairs list".
7. Click on OK.

The output will appear on the screen.

### 16.7.4 Rank correlation test

This is used to find out the correlation between two sets of ranks.

Two judges in a beauty competition rank the 10 entrants as follows:

Judge I	5	2	3	4	1	6	8	7	10	9
Judge II	4	5	2	1	6	7	10	9	11	12

Is there any correlation between the points given by the two judges?

### 16.7.5 Kolmogorov-Smirnov test

This is used for examining the efficacy of fit between observed samples and expected frequency distribution of data when the variable is in the ordinal scale.

*Example:*

A manufacturer of cosmetics wants to test four different shades of the liquid foundation compound - very light, light, medium and dark. The company has hired a market research agency to determine whether any distinct preference exists towards either extremes. If so, the company will manufacture only the preferred shade, otherwise, the company is planning to market all shades. Suppose, out of a sample of hundred, 50 preferred "very light shade" 30 liked light shade, 15 the medium shade, and 50 dark shade. Do you think the results show any kind of preference?

Since the shade represents ordering (rank), this test can be used to find the preference.

### 16.7.6 Run-test for Randomness

Consider the example of arrival of customers at a branch office of a telephone department for payment of telephone bills after the due date. The senior officer of the telephone department wants to verify whether the gender of arriving customer is random.

*Example:* Sequence of arriving customers is as shown below. M is Male F is Female.

MM FFF    MMM FFF    M    F    MMMM    FF

No. of male = 10

No. of female = 9

No. of run = 8

### 16.7.7 Sign-test

Sign-test is used with matched pairs. The test is used to identify the pairs and decide whether the pair has more or less similar characteristics.

*Example:* Suppose, an experiment on the effect of brand name on quality perceptions is to be conducted. 10 persons are selected and asked to taste and compare the two products (beverage). One of them is identified as branded well known beverage, and the other is a new beverage. In reality, the samples are identical. The respondents who tested were asked to rate the two samples on an ordinal scale. Two hypotheses are set up as follows:

$H_0$  - there is no difference between the perceived qualities of two beverages.

$H_A$  - there is a difference in the perceived qualities of two beverages.

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### SUMMARY

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Hypothesis is a proposition which the researcher wants to verify. There are two types of hypothesis, descriptive and relationship, there are several types of hypothesis such as theory, observation, past experience and case studies. There are several characteristics of the hypothesis, which decides whether a hypothesis is good or bad. Researcher will form 2 hypothesis (a) Null hypothesis (b) Alternative hypothesis, for accepting or rejecting the statement. There are 2 types of tests one tailed test or two tailed test. Two types of error may occur while testing hypothesis (a) Hypothesis is rejected when it is true (b) Hypothesis not rejected when it is false former is known as types error and later is known as type 2 error.

There are 2 types of statistical test parametric test and non parametric test. In parametric test distribution is considered as normal. Non parametric tests are easy to use. In data analysis researcher may wish to analyse one or more variable at a time. Z test, T tests are examples of parametric tests. Based on the size of sample more than 30 or less than 30, appropriate tests are chosen chi square, cox and stuart test, Mann whitney tests are examples of non parametric test. Rank sum test is used when more than two population is involved. Goodness of fit is examined by kolmogorw smirnov test.

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### KEYWORDS

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Hypothesis

univariate statistic

Bivariate statistic

Chi square test

Degree of freedom

F- statistic

Kruskal wallis test	Rank sum
Multi variate analysis	Parametric test
Non parametric test	Type I error
Variable	Variance
Z test	T test
Mann whitney	“U” test
Cox & Stuart test	

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## REVIEW QUESTIONS

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1. What is Hypothesis?
2. What is null hypothesis and alternate hypothesis?
3. Distinguish Theory and Hypothesis?
4. Explain briefly various types of hypothesis.
5. Explain the various sources from which hypothesis are derived?
6. What are the characteristics of hypothesis? Explain each one in detail.
7. What are the various steps used to test hypothesis?
8. What is a one tailed and two tailed test?
9. When is two tailed test preferred to one tail test?
10. What is type I & type II error? Give examples.
11. What is null Hypothesis & alternate Hypothesis?
12. Differentiate univariate Hypothesis from multivariate Hypothesis tests.
13. Distinguish parametric & non parametric test.
14. What is meant by (a) Significance level (b) Degree of freedom
15. What are univariate and bivariate analysis?
16. What are Ztest and Ttest and when each one is suitable?

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## ASSIGNMENT

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What hypothesis, test and procedure would you use in the following situation?

- a. An automobile company has manufacturing facility at two different geographical locations. Each location manufactures two-wheelers of a different model. The customer

wants to know if the mileage given by both the models is the same or not. Samples of 45 numbers may be taken for this purpose.

- b. A company has 22 sales executives. They underwent a training programme. The test must evaluate whether the sales performance is unchanged or improved after the training programme.
- c. A company has three categories of managers:
  - 1. With professional qualifications but without work experience.
  - 2. With professional qualifications accompanied by work experience.
  - 3. Without professional qualifications but with work experience.

A study was conducted to measure the motivation level of each of the category of managers. Formulate a hypothesis, suggesting testing procedures to show that there is no relation between the category of managers and the level of motivation.





# Research Report



In this chapter, the following questions are discussed:

- ❖ What is an oral report and what are the guidelines to oral report presentation?
- ❖ What are the types of written reports?
- ❖ What is the difference between an oral report and a written report?
- ❖ How to prepare a research report?
- ❖ How to write a bibliography?

## MARKET RESEARCH REPORT

There are two types of reports (1) Oral report (2) Written report.

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### 17.1 ORAL REPORT

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This type of reporting is required, when the researchers are asked to make an oral presentation. Making an oral presentation is somewhat difficult compared to the written report. This is because the reporter has to interact directly with the audience. Any faltering

during an oral presentation can leave a negative impression on the audience. This may also lower the self-confidence of the presenter. In an oral presentation, communication plays a big role. A lot of planning and thinking is required to decide 'What to say', 'How to say', 'How much to say'. Also, the presenter may have to face a barrage of questions from the audience. A lot of preparation is required; the broad classification of an oral presentation is as follows.

### **17.1.1 Nature of an Oral presentation**

#### **Opening**

A brief statement can be made on the nature of discussion that will follow. The opening statement should explain the nature of the project, how it came about and what was attempted.

#### **Finding/Conclusion**

Each conclusion may be stated backed up by findings.

#### **Recommendation**

Each recommendation must have the support of conclusion. At the end of the presentation, question-answer session should follow from the audience.

#### **Method of presentation**

Visuals, if need to be exhibited, can be made use of. The use of tabular form for statistical information would help the audience.

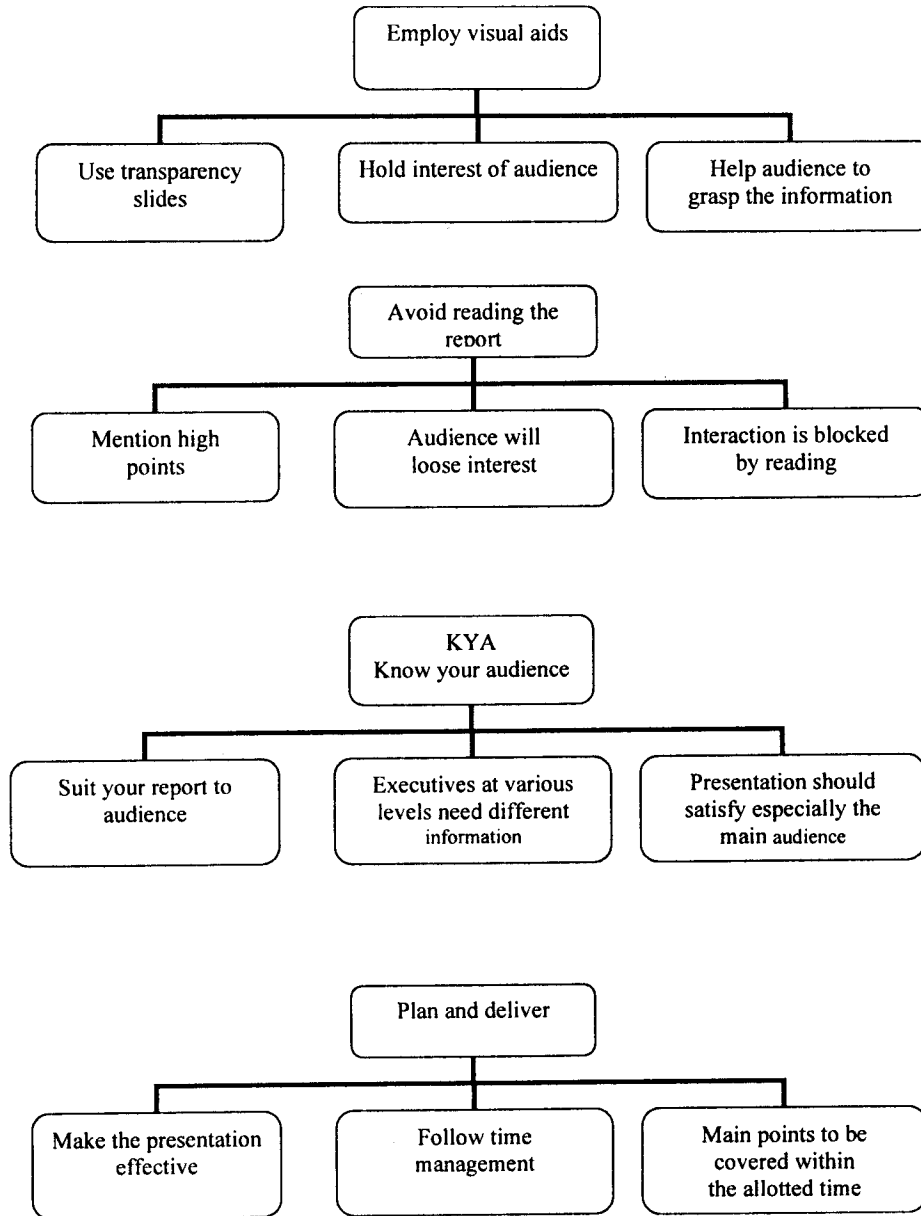
- (a) What type of presentation is a root question? Is it read from a manuscript or memorised or delivered ex-tempo. Memorisation is not recommended, since there could be a slip during presentation. Secondly, it produces speaker-centric approach. Even reading from the manuscript is not recommended, because it becomes monotonous, dull and lifeless. The best way to deliver in ex-tempo; is to make main points notes, so that the same can be expanded. Logical sequences should be followed.

Points to remember in oral presentation:

1. Language used must be simple and understandable.
2. Time Management should be adhered.
3. Use of charts, graph etc. will enhance understanding by the audience.
4. Vital data such as figures may be printed and circulated to the audience so that their ability to comprehend increases, since they can refer to it when the presentation is going on.

5. The presenter should know his target audience well in advance to prepare tailor-made presentation.
6. The presenter should know the purpose of report such as “Is it for making a decision”, “Is it for the sake of information” etc.

### 17.1.2 Guidelines



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## 17.2 TYPES OF WRITTEN REPORTS

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(A) Reports can be classified based on the time-interval such as:

- (1) Daily
- (2) Weekly
- (3) Monthly
- (4) Quarterly
- (5) Yearly

(B) Type of reports:

- (1) Short report
- (2) Long report
- (3) Formal report
- (4) Informal report
- (5) Government report

### Short report

Short reports are produced when the problem is very well defined and if the scope is limited. Eg. Monthly sales report. It will run into about five pages. It consists of report about the progress made with respect to a particular product in a clearly specified geographical locations.

### Long report

This could be both a technical report as well as non-technical report. This will present the outcome of the research in detail.

### Technical report

This will include the sources of data, research procedure, sample design, tools used for gathering data, data analysis methods used, appendix, conclusion and detailed recommendations with respect to specific findings. If any journal, paper or periodical is referred, such references must be given for the benefit of reader.

### Non-technical report

This report is meant for those who are not technically qualified. Eg. Chief of the finance department. He may be interested in financial implications only, such as margins, volumes etc. He may not be interested in the methodology.

**Final report**

*Example:* The report prepared by the marketing manager to be submitted to the Vice-President (marketing) on quarterly performance, reports on test marketing.

**Informal report**

The report prepared by the supervisor by way of filling the shift log book, to be used by his colleagues.

**Government report**

These may be prepared by state governments or the central government on a given issue.

*Example:* Programme announced for rural employment strategy as a part of five-year plan or report on children's education etc.

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### 17.3 DISTINGUISH BETWEEN ORAL AND WRITTEN REPORT

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Oral report	Written report
No rigid standard format	Standard format can be adopted.
Remembering all that is said is difficult if not impossible. This is because the presenter cannot be interrupted frequently for clarification.	This can be read a number of times and clarification can be sought whenever the reader chooses.
Tone, voice modulation, comprehensibility and several other communication factors play an important role.	Free from presentation problems.
Correcting mistakes if any, is difficult.	Mistakes, if any, can be pinpointed and corrected.
The audience has no control over the speed of presentation.	Not applicable.
The audience does not have the choice of picking and choosing from the presentation.	The reader can pick and choose what he thinks is relevant to him. For instance, the need for information is different for technical and non-technical persons.

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### 17.4 PREPARATION OF RESEARCH REPORT

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Having decided on the type of report, the next step is report preparation. The following is the format of a research report:

1. Title Page
2. Page Contents

3. Executive Summary
  - ❖ Objectives
  - ❖ Results
  - ❖ Conclusions
  - ❖ Recommendations
4. Body
  - ❖ Introduction
  - ❖ Methodology
  - ❖ Results
  - ❖ Limitations
5. Conclusions and Recommendations
6. Appendix
  - ❖ Sampling plan
  - ❖ Data collection forms
  - ❖ Bibliography

1. **Title Page:** Title Page should indicate the topic on which the report is prepared. It should include the name of the person or agency who has prepared the report. The date of the submission of the report is to be included in the report.
2. **Table of Contents:** The table of contents will help the reader to know “what the report contains”. The table of contents should indicate the various parts or sections of the report. It should also indicate the chapter headings along with the page number.

**Table of Contents**

Section	Description	Page No.
I	Background, Purpose of study	1-3
II	Methodology	4-8
III	Analysis and interpretations	9-10
IV	Findings	11-12
V	Recommendations	13
VI	Conclusion	14
VII	Appendix	
	a) Questionnaire	16-25
	b) Exhibits	26-40
	c) Bibliography	41

3. **Executive Summary:** If your report is long and drawn out, the person to whom you have prepared the report may not have the time to read it in detail. Apart from this, an executive summary will help in highlighting major points. It is a condensed version of the whole report. It should be written in one or two pages. Since top executives read only the executive summary, it should be accurate and well-written. An executive summary should help in decision-making.

*An executive summary should have,*

- ❖ Objectives of the research report
  - ❖ Scope of the study
  - ❖ Limitations
  - ❖ Key results
  - ❖ Conclusions
  - ❖ Recommendations
4. **The Body:** This section includes:
- ❖ Introduction
  - ❖ Methodology
  - ❖ Results
  - ❖ Limitations

**Introduction:** The introduction must explain clearly the decision problem and research objective. The background information should be provided on the product and services provided by the organisation which is under study.

**Methodology:** How you have collected the data is the key in this section. For *example*, Was primary data collected or secondary data used? Was a questionnaire used? What was the sample size and sampling plan and method of analysis? Was the design exploratory or conclusive?

**Results:** What was the final result of the study?

**Limitations:** Every report will have some shortcoming. The limitations may be of time, geographical area, the methodology adopted, correctness of the responses, etc.

5. **Conclusion and Recommendation:**
- ❖ What was the conclusion drawn from the study?
  - ❖ Based on the study, what recommendation do you make?

6. **Appendix:** The purpose of an appendix is to provide a place for material which is not absolutely essential to the body of the report. The appendix will contain copies of data collection forms called questionnaires, details of the annual report of the company, details of graphs/charts, photographs, CDs, interviewers instructions.
- ❖ **Bibliography:** If portions of your report are based on secondary data, use a bibliography section to list the publications or sources that you have consulted. The bibliography should include, title of the book, name of the journal in case of article, volume number, page number, edition etc.

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## 17.5 HOW TO WRITE A BIBLIOGRAPHY

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Bibliography, the last section of the report comes after appendices. Appendices contains questionnaires and other relevant material of the study. The bibliography contains the source of every reference used and any other relevant work that has been consulted. It imparts an authenticity regarding the source of data to the reader.

Bibliography are of different types viz., bibliography of works cited; this contains only the items referred in the text. A selected bibliography lists the items which the author thinks are of primary interest to the reader. An annotated bibliography gives brief description of each item. The method of representing bibliography is explained below.

### Books

Name of the author, title of the book (underlined), publisher's detail, year of publishing, page number.

- Single Volume Works. Dube, S. C. "India's Changing Villages", Routledge and Kegan Paul Ltd., 1958, p. 76.

### Chapter in an edited book

- Warwick, Donald P., "Comparative Research Methods" in Balmer, Martin and Donald Warwick (eds) 1983, pp. 315-30.

### Periodicals Journal

- Dawan Radile (2005), "They Survived Business World" (India), May 98 pp. 29-36.

### Newspaper, Articles

- Kumar Naresh, "Exploring Divestment" The Economic Times (Bangalore), August 7, 1999 p. 14.



## Website

- www.infocom.in.com

## For citing Seminar paper

- Krishna Murthy, P., “*Towards Excellence in Management*” (Paper presented at a Seminar in XYZ College Bangalore, July 2000).

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## SUMMARY

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The most important aspect to be kept in mind while developing research report, is the communication with the audience. Report should be able to draw the interest of the readers. Therefore, report should be reader centric. Other aspect to be considered while writing report are accuracy and clarity.

The point to be remembered while doing oral presentation is language used. Time management, use of graph, purpose of the report etc. Visuals used must be understandable to the audience. The presenter must make sure that presentation is completed within the time allotted. Sometime should be set apart for questions and answers.

Written report may be classified based on whether the report is a short report or a long report. It can also be classified based on technical report or non technical report. Written report should contain title page, contents, executive summary. Body conclusions and appendix. The last part is bibliography.

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## KEYWORDS

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Oral report	Written report
Informal report	Appendix
Bibliography	Body page content
Executive summary	

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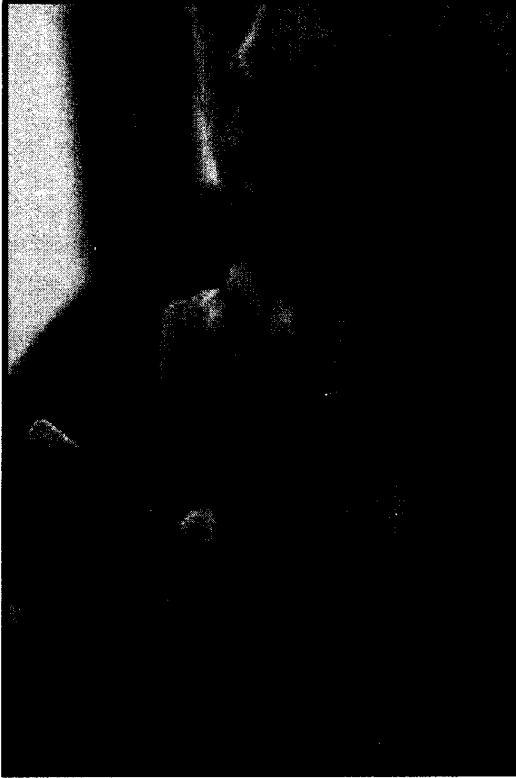
## REVIEW QUESTIONS

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1. What are the criterion for an oral report? Explain.
2. What is meant by “consider the audience” when writing a research report.
3. On what criteria, oral report is evaluated. Suggest a suitable format.

4. Why are visual aids used in oral presentation?
5. What are the various criteria used for classification of written report?
6. What are the essential content of the following parts of research report?
  - a. Table of contents
  - b. Title page
  - c. Executive summary
  - d. Introduction
  - e. Conclusion
  - f. Appendix
7. Oral presentation requires the researcher to be good public speaker. Explain.

# Ethical Issues in Business Research



In this chapter, the following questions are discussed:

- ❖ What are ethical issues involved with respect to:
  - Respondents
  - Buyers and clients
  - Researchers

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## 18.1 ETHICAL ISSUES IN BUSINESS RESEARCH

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Ethics is nothing but the accepted codes of conduct. Ethics in business research is very much required and relevant in today's industrial scenario. The ethical issues involved in business research can be studied from three different angles.

- a) Ethics in the treatment of the respondent.
- b) Ethics in the treatment of buyers and clients.
- c) Ethics in the treatment of researchers.

### 18.1.1 Ethics in the treatment of the respondent

An ethical code of conduct must consider the following things:

1. Information that should not be disclosed and made public i.e., participants name and secrecy must be protected.
2. Data collected from respondents must be correct and should not be manipulated.
3. The rights of the respondents must be protected.
  - ❖ *Right to privacy:* The researcher should convince the customer that the survey does not involve unethical things and it is being conducted for mutual benefit. Eg. Skin care products should not mislead the user.
  - ❖ *Right to choose:* The customer must be allowed to choose what he wants. (No force should be exerted by sellers on the buyer. )
  - ❖ *Right to safety:* The researcher must not inflict psychological harm by putting the respondents under pressure to answer. )
  - ❖ *Right to be informed:* The researcher must inform the customer in advance about ( the purpose of gathering the information. )

### 18.1.2 Ethics in the treatment of buyers and clients

- i. The method for conducting the research and the results obtained should be accurate.
- ii. The researcher should keep the identity of the client confidential.
- iii. If the client request or demands an unethical research, the researcher should refuse to take up the ill-advised research for his clients. Maintaining confidentiality and secrecy is of utmost importance and it is a part of the ethical code of conduct to be followed by the researcher.

### 18.1.3 Ethics in the treatment of researchers

- *Selecting the bidders:* Sometimes firms, for the sake of formality, call for quotations from a number of market research agencies, even though they have already decided to whom the project should be given. This is an unethical practice in the matter of selection of researchers.
- *Limited funds:* Certain firms have limited funds allocated to carry out the research. For *example*, the firm may have a budget to be conducted on a regional basis but the firm does not make this clear to the researcher while inviting proposals. It may so happen that such ambiguity may cause the researcher to prepare his proposal for a

nationwide research, but upon bagging the project, the funds released are sufficient only to conduct research on regional basis. This may frustrate researchers besides, it is an unethical practice.

- *Non-availability of data:* Some firms give projects to their researcher, but do not provide him with required sales and cost data. Since this may be the basis for carrying out the research, the researcher feels frustrated at not receiving the basic promised data. This is an unethical on the part of the client firm.
- *Pseudo-Pilot studies:* Some clients ask the research agencies to conduct pilot studies and promise that if the researcher does a good job during the pilot study stages, there will be an additional major contract immediately. Most often, this comprehensive study never materialises and the research agencies absorb a huge loss. This is not an ethical practice.
- *Political research:* Political organizations hire some research consultants to carry out a research. In such cases, there is all likelihood that the consulting firm or organisation will be politically pressurised to produce reports and forecast in favour of the party commissioning it. This is also a very unethical practice.

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## SUMMARY

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Ethics is accepted code of conduct. Ethical issues of business research can be studied under 3 different entities. Maintaining integrity is important in research. Acts such as lack of confidentiality, falsifying, holding back the information etc should be avoided.

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## KEYWORDS

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Ethics	Client
Pseudo Studies	Disguised
Bidder	

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## REVIEW QUESTIONS

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1. What is meant by ethics?
2. What are some of the ethical issued faced by marketing researcher for conducting field studies.

3. What are the ethical issues in the treatment of the following
  - a) respondents
  - b) researchers
  - c) clients
4. Do you think ethics are important for the conduct of a research? Why and Why not?.

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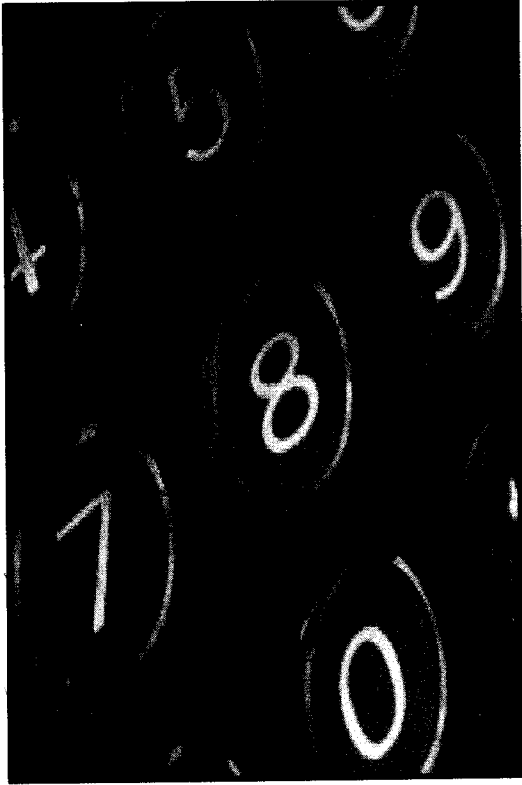
## ASSIGNMENT

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Each of the following raises ethical issues that we come across in the market. For each situation identified, “state what you believe to be an ethical issue, and the remedial action you would take”.

1. A company receives a proposal from many research organisations for conducting studies. The company gathers all the ideas and finally awards the research project to one of the organisations. The other organisations are not compensated for their ideas.
2. A research organisation undertakes a project, knowing fully well that the project cannot be completed on time.
3. A company asks a research firm to conduct a study on the customers of its competitor firm.
4. A research organisation might think of doling out gifts and favours to capture more business.
5. A researcher is asked to prepare a proposal for a nationwide research, but is later asked by the client to limit the research to a particular region, owing to constraints in funds.

# Market Information System



**In this chapter, the following questions are discussed:**

- ❖ What is marketing information system?
- ❖ What is Market Intelligence System?
- ❖ What is the need for data base in marketing research?
- ❖ What is the distinction between the market intelligence and marketing research?

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## 19.1 MARKET INFORMATION SYSTEM (MIS)

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Market information consists of people, equipment and procedure to gather, sort, analyse, evaluate and distribute the needed timely information to marketing decision-makers.

The information (MIS) can be developed through:

- (1) Internal company records;
- (2) Marketing intelligence; and
- (3) Market decision support system.

### 19.1.1 Internal company records

- (a) *Internal company records* pertain to sales, price, inventory, receivables, payables and so on.

The heart of the information system is the internal record system of the company. Sales representatives, dealers and customers dispatch orders to the firm. The sales department prepares invoices and sends copies to various departments. If the item is in stock, it is dispatched to the customer. The shipping and billing document is sent to various departments. Today, e-mails are used to carry out the above function.

- (b) *Sales information system*: Marketing managers need information on up-to-date current sales. Immediate feedback from customers to the corporate office is the order of the day. In recent times, the sales force software has made great progress.

A company's marketing information system should represent a cross between what managers think they need, what managers really need and what is economically feasible. An internal MIS committee can interview a cross-section of marketing managers to discover their information needs. Some useful questions are:

1. What decisions do they regularly make?
2. What information do they need to make their decisions?
3. What information do they regularly get?
4. What information do they need now which they are not getting now?
5. What information do they need (a) daily (b) weekly (c) monthly (d) yearly?
6. What data analysis programme do they want?
7. What topics do they want to be kept informed about?
8. What special studies do they need periodically?

### 19.1.2 Marketing Intelligence System

This refers to a set of procedures and sources used by managers to obtain everyday information about developments in the marketing environment.

Marketing managers collect marketing information by reading books, newspaper and trade publications, talking to customers, suppliers and distributors. A company can take several steps to improve the quality of marketing intelligence.

First, it can train and motivate the sales force, to spot and report any new development in the market. Sales representatives are the eyes and ears of the company. They are in a



position to pick up the information lost by others. Sales representatives should know which type of information is to be sent to managers.

**Second**, the company can motivate distributors, retailers and other intermediaries to pass along important intelligence.

**Third**, the companies can learn about competitors by purchasing their products, attending trade shows, reading competitors' published reports, attending stock holders meetings, talking to employees, dealers and suppliers' freight agents.

**Fourth**, the company should set up a customer advisory panel made up of representatives, customers or the company's largest customers, or the most out-spoken or sophisticated customers. Hitachi of Japan follows this practice.

**Fifth**, the company can purchase information from outside suppliers.

**Sixth**, some companies have established a market information system centre to collect, and circulate marketing intelligence. The staff browse the internet, major publications, newspapers and well known trade journals to record the relevant information. Recorded information is used to make marketing or business decisions.

### 19.1.3 Importance of Data Base in M.R

**Data Base:** It contains data from all sources and stores then district-wise, city-wise, state-wise, etc. The data base is constantly updated.

#### Need for Data Base

1. Assists interaction with current and potential customers.
2. Helps in planning a promotion programme.
3. Help to provide what customer wants.

A marketing data base contains information on customers and their characteristics. A data base helps the marketer predict the future preferences of the customers from the past data.

#### Contents of Data Base

- Identification of each customer through code
- Name of the organisation
- Address and postal code, e-mail ID
- Time-period when the transaction was carried out
- Amount in rupees (volume of transaction).

### **19.1.4 Type of Data Base**

Customer data base can be divided into (a) Active customer data base (b) Inactive customer data base.

An active customer data base will contain the following:

1. How often does a customer purchase?
2. How much do they purchase?
3. When was the last purchase made?
4. How often did they complain and what was the nature of their complaint?

The above information helps in planning customer-related activities, such as promotions, discounts and after-sales service.

#### **Inactive customer data base**

1. The period during which they are inactive.
2. Any attempt made to reactivate the customer. If so, when and what?

### **19.1.5 Benefits of Data Base Marketing**

#### **Retention of the customer**

It should be remembered that an organisation needs to spend five times more to acquire a new customer, compared to retaining an existing customer. Generally, it is an accepted fact that 20% of the customers are responsible for 80% of the business. Therefore, maintaining an excellent relationship with customer becomes imperative.

#### **Estimate the value for Lifetime of a customer**

Each customer when valued is an asset to the organisation. If a cell phone subscriber pays Rs. 300 per month, he is worth 2.5 lakh rupees assuming he continues with the same service-provider for 30 to 40 years.

### 19.1.6 Distinction between Marketing Intelligence and Marketing Research: A Contrast

Market intelligence	Market research
It is a continuous process.	It is project based and is being conducted when there is a problem in the company.
It doesn't always provide an immediate solution to the problem.	MR provides solutions to the immediate problem faced by the company.
There is no specific methodology to gather the data.	A specific methodology is followed for collection of data from the respondents.
Not a highly expensive system	A highly expensive system.
Data collection is not specific.	Data pertaining only to the problem is being collected.
Research design is not required for the system.	Research design is very important in marketing research.

#### SUMMARY

A good marketing information system should determine the various information needs of the organization. These information can be got from internal source or from external sources.

Data base is a source of information about individuals or organizations. Data base may contain customer's purchase history, demographic life style etc. data base helps to locate potential prospects. When a transaction takes place certain relationship is developed. Relationship marketing focus on retention of customer forever.

#### KEYWORDS

MIS	Internal records
Marketing intelligence	MDSS
Data base	Retention
Life time value	Marketing research

#### REVIEW QUESTIONS

1. Discuss in detail marketing information system.
2. What are the ways to develop MIS?

3. Explain the following

- a) data base
- b) need for data base
- c) contents of base
- d) types of data base
- e) benefits of data base marketing

4. Distinguish between marketing information and market research.

5. Discuss the role of data base in marketing research.

# Recent Trends in Business Research



In this chapter, the following questions are discussed:

- ❖ What are online surveys?
- ❖ What is E-Focus group?
- ❖ What are the Pop-up surveys?

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## 20.1 INTRODUCTION

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Revolutionary developments in information technology have changed the face of business research. Computers have contributed significantly in conducting analysis and reporting the research. Computers not only save time and money but also speed up the work. Presently, computer-friendly questionnaires are being developed in order to enable the computer to tabulate and present statistical analyses. Many software programmes have been developed for research purposes, like for example, the SPSS programme. By using this programme, one can apply any statistical technique to analyse the data.

Information technology has engineered a new range of tools for market researchers. The Internet is also a source for collecting abundant secondary data and relevant primary data. One of the biggest advantages of the Internet is its low cost, besides its huge saving of time. The Internet has also solved many organisational problems by providing quick and effective facilities for viz., data collection, manual works, paper work etc., Online – focus group, online-meeting, online-training, online-services, online-reporting, online-discussion etc., are common in today's organisations. Some of these concepts have been discussed as under.

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## 20.2 ONLINE – SURVEYS

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Online survey is a method, by which one can conduct the survey and collect the data via the Internet. It requires no physical movement on the part of the researcher for data collection. One way of conducting this research is to the customer to go to a particular company's website and fill the questionnaire that is displayed in the website.

Other way is collecting the e-mail Id of the sample respondents, mailing the questionnaire and asking them to return the filled questionnaire back to the company.

### **Advantages**

- Saves time.
- Saves cost.
- Data can be collected quickly.
- Some busy respondents do not show any interest in meeting the research executives. For such respondents, online surveys are ideal.

### **Disadvantages**

- All respondents may not have an e-mail Id.
- Some respondents do not possess Internet-awareness. Rural consumers do not use Internet at all. So, this method may not be applicable to all types of research.
- Information provided by respondents online may not be safe due to intruders hacking the net. Keeping this fact in mind, most of the respondents do not provide their phone numbers, credit card numbers, or financial details to the researchers for online surveys.

## 20.3 ONLINE – FOCUS GROUPS

Carrying out conventional focus groups is difficult with scattered and niche respondents. In such instances, E-focus groups are more helpful to researchers. It is a technique of creating a chat room or channel on website, where the moderator brings the scattered audience all over the world for a discussion. E-focus group cannot replace the conventional focus groups, but they will find their place. E-focus groups have no geographical restrictions. People from multiple regions can participate together in an online focus group. E-focus groups allows respondents to view texts, graphics, sounds, video or multimedia for evaluation and testing.

### Advantages

- It saves the precious time of top level executives (respondents).
- Physical movement of respondents is not required.
- It saves the cost substantially.

### Disadvantages

- It needs management of technology, which is complex in nature, and difficult.
- The moderator should have technical skills to facilitate the group through the net.
- The sustained interest of the audience is much less in E-focus groups when compared to the conventional ones.

### Focus Site Methodology

Survey Site is an online research organisation with a unique qualitative online methodology, the **Focus Site**, a method for holding an in-depth discussion among 25 or more participants over an extended period of time. The participants enter the discussion several times over 1-2 day period, depending on research objectives. The extended time period of the Focus Site allows respondents to react to, and build upon each other's ideas in a way that is often not possible during a typical two-hour focus group session. Survey Site moderators work with clients before the Focus Site is run to understand research objectives and to develop questions for the group. During the Focus Site, they lead the discussion in order to ensure that client objectives are being addressed. Clients are able to monitor the Focus Site discussion online and contribute their own questions or themes privately to the moderator, while the Focus Site group is in progress.

The **Focus Site** methodology allows clients to:

- Hold an extended discussion with 25 or more participants in order to gain in-depth insights and ideas.
- Have an in-depth discussion with customers without any geographic restrictions. Respondents worldwide can participate in the discussion.
- Explore new ideas and concepts and let respondents build upon the ideas of other respondents.
- Have respondents perform tasks (such as examining new websites or evaluating advertisements) and then give their reactions and evaluations.

*Source: surveysite.com*

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## 20.4 POP-UP SURVEYS

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For pop-up surveys, respondents are recruited from client websites. Pop-up methodology allows for the random selection of visitors to the websites, making it an ideal methodology for evaluating business issues such as customer satisfaction with the websites satisfaction with existing products and services, or the likelihood of the success of new products.

**Domain Departure**

Survey Site's **Domain Departure** is a pop-up survey methodology used specifically for evaluating visitors' experience with the websites. The Domain Departure technology randomly presents a pop-up invitation to participate in a survey as a visitor enters a website capturing visitor behaviour as they navigate the site (e.g., pages visited, time spent), and then presents a questionnaire as the respondent leaves the website. This technology also allows for the inclusion or exclusion of specific questions in the questionnaire, based on the respondent's website behaviour. The Domain Departure methodology automatically combines behavioural data with the questionnaire data and provides a deeper understanding of the website visitor experience. The result is insightful and actionable information that helps clients with their business decisions.

*Source: surveysite.com*

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### KEYWORDS

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E-Focus group	On-Line survey
Pop-up survey	SPSS
Respondents	E-Mail



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## REVIEW QUESTIONS

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1. Discuss in detail the recent trends in business research
2. What is on-line survey? What are its advantages and disadvantages?
3. What is online-focus group? What are its advantages and disadvantages?
4. Explain pop-up surveys
5. How internet is contributing to the field of business research?



# Application of Marketing Research



**In this chapter, the following questions are discussed:**

- ❖ How to undertake product research?
- ❖ What are the stages in new product development?
- ❖ What is advertising research?
- ❖ What is advertising, pre-testing and post-testing?

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## 21.1 PRODUCT RESEARCH

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One of the major areas of market research lies in product research. The market is flooded with innumerable products. The customer has several choices to make. New products keep entering the market, while older products disappear. It is the duty of the marketer to keep track of the performance of existing products and examine the possibility of introduction of new products. Examples are cell phones, bike, cars, etc.

Product research is a market research application, which tells the marketer, “what modifications are required in the existing product to meet the needs of a consumer”. As profit margins decline on established products, companies must rely on new products to sustain overall profit margins. It also helps the marketer to introduce new products. Research has proved that four out of five new products end in failure, and only a small number of products succeed. Due to ever changing needs, habits and lifestyles of the customer, product research assumes importance.

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## 21.2 NEW PRODUCT CATEGORIES

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There are six categories of new products:

1. ***New-to-the-world-products:*** This is entirely new to the market. Example: Dish washer, iced tea, frozen peas etc.
2. ***New product lines:*** These are new products of the company, but are not new to the world. *Example:* New model of a car.
3. ***Addition to the existing product line:*** New products in the form of different packaging, flavour etc. A sugar manufacturer can add additional product line such as, wine manufacturing, cardboard from residue.
4. ***Improvement in existing products:*** Modified new products. *Example:* Mobile phones-basic model to third generation model.
5. ***Re-positioning:*** Existing products are targeted at the new market by re-positioning. *Example:* Britannia repositioned biscuits as having nutritional value against the earlier positioning of biscuits as snacks.
6. ***Cost reduction:*** New products which provide similar performance, but at lower costs. *Example:* Bottles to sachets.

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## 21.3 ORGANISING NEW PRODUCT DEVELOPMENT

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Companies can handle new product development in a number of ways. They are:

1. Having a product manager.
2. Having a new product committee.
3. Having a new product department.
4. Having a new product venture team.

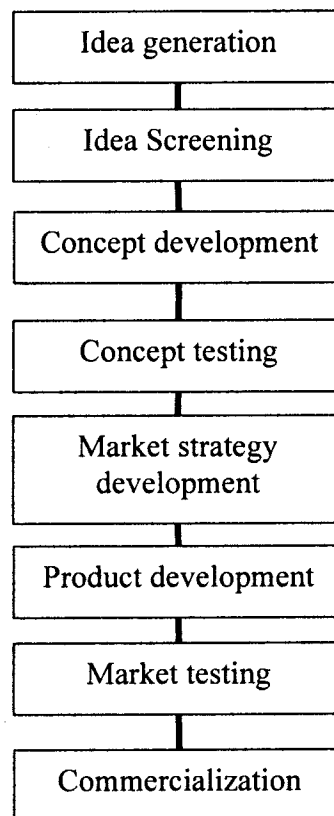
1. **Product Manager:** Most companies assign the responsibility of new products to the product manager. His job is to concentrate on the development and introduction of new products in the market.
2. **New Product Committee:** Some companies, instead of assigning a new product development to an individual, formulate a committee, which has to decide about the introduction of the new product.
3. **New Product Department:** Large companies have a separate department for development of new products, usually their R & D department.
4. **New Product Venture Team:** A venture team consisting of people from various departments with cross-functional discipline is formed and asked to develop new products.

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## 21.4 STAGES IN THE DEVELOPMENT OF NEW PRODUCT

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Flow Chart of new products:



1. **Idea generation:** The new product development begins with storage of ideas. Top management should define the product and also the scope for new products. They should state “how much effort is to be put for developing of new products”. New product ideas can be generated from any one of the following sources:
  - ❖ Customers
  - ❖ Scientists
  - ❖ Competitors
  - ❖ Employees
  - ❖ Dealers
  - ❖ Top management

In industrial marketing, new product development is usually suggested by major users. The company can also discover good ideas by buying competitors’ products and learn them by dismantling the same.

2. **Idea Screening:** The company should motivate its employees to submit their ideas to the person selected by the company as an Idea Manager. These ideas should be written down and reviewed each week by an Idea Committee which sorts out the ideas. The ideas can be classified as under:
  - ❖ Lousy ideas
  - ❖ Unsuitable ideas
  - ❖ Ideas that have little potential
  - ❖ Some one else is already exploiting it
  - ❖ No long-term potential for the idea
3. **Concept development and testing:** Let us take an example of concept development. A large food processing company hits upon the idea of producing a powder to add to milk to increase its nutrition value and taste. This is known as product idea. The consumers do not buy product ideas. They buy product concepts.

A product idea can be turned into several concepts. The first question is “Who will buy this product”? “Is the powder aimed at infants, teenagers, young and middle aged adults, older adults etc.”?

Secondly, “What primary benefit should this product provide”? “Is it taste, nutrition, refreshment, energy”?

Thirdly, “When will people consume this milk”? “Would it be during breakfast, mid-morning, lunch, dinner, or late evening”? By seeking answers to these questions, the company can form several concepts.

*Concept 1:* Instant breakfast drink for adults.

*Concept 2:* The taste is suitable for children to drink as a mid-day refreshment.

*Concept 3:* A health supplement for older adults, possibly preferred in the evening before going to bed.

*Concept Testing:* Concept testing involves presenting the product concept on appropriate target consumers and get their reactions. After obtaining their reactions, the consumer will have to respond to the following questions:

- ❖ Are the benefits clear to you?
- ❖ Do you see this product solving your problem or fulfilling your need?
- ❖ Do other products currently meet this need and satisfy you?
- ❖ Is the price reasonable in relation to the value?
- ❖ Would you think (definitely, probably, probably not, definitely not) of buying the product?
- ❖ Who would use this product and how often is the product used?

4. *Market Strategy Development:* Here, the product manager has been following the plan. The plan consists of three parts:

- ❖ Describe the target market size — structure and behaviour
- ❖ Who will distribute the product and how well would you position the product?
- ❖ What is the anticipated profit for the first three years?

The target market for an instant breakfast drink is families with children who want a convenient, nutritious and inexpensive form of breakfast.

The company brand may have to be positioned. Under the distribution, the manager will have to decide what are the variants in the drinks that are being offered such as chocolates, vanilla, strawberry, etc.

What is the size of the each box?

The advertising copy has to be released emphasising the benefits of nutrition and convenience. Free samples will have to be distributed door to door. Further, the marketing strategy is to calculate what may be the profitability vis-à-vis expenses to be incurred for the first three years. Maybe the promotion budget will be 20% to start with and may gradually taper off at the end of three years.

5. *Product development:* In product development, R and D has to develop the samples and submit the prototype for testing. This calls for a major investment by the company in R&D.

6. **Market testing:** After the management is satisfied, the product is ready to be branded and packaged to be put to market. For this purpose, a potential test market is chosen and testing is done, varying from two to four months.
7. **Commercialisation:** If everything goes well, the product is commercialised. The plant will have to manufacture the product in full scale and the distributors will have to take up the marketing of the products as agreed upon.

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## 21.5 MORPHOLOGICAL ANALYSIS

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It is a special technique in brainstorming. A product can be described in terms of various attributes. In Morphological Analysis, each attribute of a product is broken down into several alternatives. These different alternatives are later combined.

*Example:* A music system has in-built speakers, detachable speakers, head phones. All the three are used to listen to music. This system can draw power from battery eliminators, cell or electrical mains. Thus, there are nine possible combinations. Some combinations are technically feasible and some are not. However, this analysis provides several alternatives to develop a product.

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## 21.6 SEQUENTIAL PRODUCT DEVELOPMENT AND SIMULTANEOUS PRODUCT DEVELOPMENT: A CONTRAST

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In sequential product development, the following steps are followed:

The R and D department will come out with a broad idea and they will conduct research on it. Once, the research is completed, it is handed over to the design and production staff. Finally, the quality-control staff check the product after manufacturing or during manufacturing. The ultimate product then goes to the marketing department, which is responsible for selling it. This is known as sequential approach and also called the sequential method of product development. This is because, each department in turn checks the development of product and then passes it on to the next stage for further processing. However, this sequential approach has a great disadvantage. The production people may ask the design people to redesign the product, if it cannot be manufactured within the budgeted cost. The design people take their own time for re-designing. Similarly, the design people may ask the R and D people to look at the ideas once again. Thus, there is a delay in each stage and finally the marketing department may get a product which is not acceptable to the customer at the price quoted. As a result, each party blames the other if there is a failure. This entire process is known as sequential product development.



### 21.6.1 Simultaneous Development

The problems of laying blame on others and delays can be solved by a team approach. In this case, cross-functional teams are formed and there will be a product leader for each stage. The team will approve the product and send it across to the next stage. Simultaneous product development turns out to be a quicker method of developing the product compared to the sequential method.

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## 21.7 PRODUCT TESTING

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Product testing aims at examining how users perceive a product's value or benefits. Product testing can be done under two different types of environment, namely (1) Central location (2) In-home placement. In the first case, product testing takes place in a supermarket or a shopping mall. Here, the respondents are chosen at random and asked to try the product. A carefully constructed questionnaire is used to decipher the response.

While conducting an in-home placement test, the products are left behind at the respondents' house for a specified period of time. While leaving the product at home, all the labels or identification are removed. Here too, a questionnaire is used to elicit respondent's opinion. We may adopt three different approaches to find out the performance of a product.

1. ***Test the product alongside a standard product:*** In this case, a standard product is used along with product to be tested. The standard product may belong to a company, which is a market leader. The standard product may be that of a competitor.
  2. ***Horse-racing alternatives:*** Several products of the same company are put to test against one another. Out of this, the product which gains maximum acceptance from consumers is finalised.
  3. ***Testing against historical standards:*** In this case, the test is conducted against a product that has achieved great success, but is not directly involved in the test. This is not a common method. The most popular product testing methods are:
    - a) Monadic test
    - b) Paired Comparison test
    - c) Preference and Discrimination test.
- a. ***Monadic test:*** In this method, the respondent evaluates only one product. He does not use other products for reference or benchmarking. The respondent is expected to recall another product which is similar to the product being tested. The respondents used here may be individuals or several groups of respondents. In case of groups, each group is required to evaluate one product only. This is a very practical method of

evaluating a product, since consumers use one product at a time and they will also be able to compare it with other products which they are using at present. The disadvantage of this method is that since only one product is evaluated at a time, it is costly and time consuming.

b. *Paired comparison test:* This is a very commonly used method. In this method two products are given to the respondent. It is presented to in a 'blind' manner. One of the products may be that of competitor or their own product. There are three types of paired comparison test.

- i. Side-by-side paired comparison
- ii. Sequential or staggered paired comparison
- iii. Non-directive paired comparison.

i) *Side-by-side paired comparison:* In this test, two products are given. The respondent will use one at a time. After using both products, the respondent is asked to indicate his/her preference. These types of tests are not usually satisfactory because respondents may indicate their preference in favour of an unknown brand. This may be because, the respondents desire to please the researcher or they might be influenced to think that the product is better. Biases are likely to creep in with such types of experiments. This type of test is conducted for developing a prototype.

ii) *Staggered comparison test:* This test is similar to side-by-side comparison test. The difference is in the time gap between the use of two products. Use one product first and a week or ten days later, try second product. The identity of the two products are masked. 50% of respondents receive one product say X first, and another 50% of respondents receive product Y first.

This is done to prevent any subjectivity or bias. This test is close to reality because customers usually buy one product at a time instead of two brands of the same product.

iii) *Non-directive method:* This type of product test is very closure to actual market conditions. Respondents are given a pair of products in exactly the same fashion. The respondents are asked to use the product. They are not told that a follow up interview will be conducted at a later date. The impression that respondents gets when they are handed over the products is that they may get free samples offered by the company.

Two weeks later, the respondents are contacted by the interviewer. He conducts a disguised type of interview with the respondent. He asks then about their views and experience regarding the product. The interviewer must make sure that the product

is used. Respondents are given an opportunity to talk freely, indicate whether any differences are noticed or not. If no differences are indicated, non-disguised questions are asked.

- c. **Preference and discrimination test:** This test is designed to find out customers capability to differentiate two products. In this test, the customer is required to indicate the significant difference between a new product A and an old product B. There are two types of product discrimination test:
- i. Triangular (triadic)
  - ii. Double pair test
- i. **Triangular (triadic):** In triadic test, three products of which two are identical labelled A and the other being different, labelled B, are given to the respondents after masking. One group gets A-A-B and the other group gets A-B-B. The respondent is informed that two out of the three products are identical, and the other one is different. The respondent is required to identify them.
  - ii. **Double pair test:** This is very similar to a paired comparison test conducted upon the same respondent. The pair of products used in the first and second tests are the same but the respondents are not informed about this. On the basis of random choice, one would expect a respondent to pick any one preferred product.

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## 21.8 TEST MARKETING

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Test marketing is carried out to find out the acceptance level of the product. A new product is introduced in a small geographical territory, and commercial viability is checked. This procedure is known as test marketing. Test marketing helps the management in two ways.

1. It helps in ascertaining the potential sale and profit for the new product.
2. It also helps to carry out any correction required before launching on a commercial scale.

With test marketing, companies can minimize losses. Information collected in test marketing is as follows:

1. Awareness level.
2. Reasons for not using a product.
3. User experience about the product.
4. Usage pattern of the product.

5. Reaction to the product by retailers.
6. Purchasing pattern.
7. Characteristics of buyers.
8. Effectiveness of advertising.
9. Reaction to offers made by company.

### 21.8.1 Designing Test Marketing

While designing test markets, the following factors should be taken into account:

- a. Time duration of the test.
  - b. Criteria used to select test markets.
  - c. Decide what to measure.
- a) *Time duration of the test:* At least three repurchases should be allowed, before the sales are estimated. This is because it has been found that in case of some products, initial purchases are large and subsequently the product met its end value. Therefore, a duration should be allowed before drawing any conclusion on the sales volume. There is no fixed rule as to how long a market test should last. It may run for three to six months, long enough to observe the purchase behaviour. Therefore, shorter the repurchase period of the product, shorter will be the test marketing period.
- Example:* Cigarettes or soft drinks have a short purchase cycle, whereas toothpaste or bath soap have a longer purchase cycle. They require a longer test market period. Test marketing period is also influenced by the speed at which the competitors react. Competitors might introduce an identical product in the market during the same period. Not all products are test marketed. Highly expensive items like automobiles, refrigerators, cannot be put to this test, because the cost will be prohibitively high.
- b) *Criteria used to select a test market:* The following criteria may be used to select a test market:
1. The market chosen for test marketing should not be too small or too big. If it is too small, the results are not reliable. If it is too big, the cost escalates.
  2. A single industry should not dominate the market.
- c) *Decide what to measure:*
- i) *Effectiveness of advertising:* In this case, the product awareness of the customer is measured. How much the customer is aware of the product feature, how long he is able to retain the advertisement, etc: Awareness depends on how effective is