B Com (Hons) IV Semester

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For the students of

B. Com. (Hons), Sem: IV

Name of Paper Company Law & Secretarial Practices

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COMPANY SECRETARY: SECRETARIAL PRACTICE

Meaning of Company Secretary: The word ósecretaryô is derived from the Latin word ósecretariusô meaning óconfidential officerô. Therefore, it can be said that the secretary is a confidential officer of the company who is responsible for the management of financial and legal issues.

According to Section2(24), of the Companies Act, 2013 ñ Company secretary or secretary means a company secretary as defined in section 2(1)(c) of the Company Secretaries Act, 1980 who is appointed by a company to perform the functions of a company secretary under this Act.ò

In general, the terms Secretary can be defined as a person who is a member of company secretaries of India, appointed by the Board of Directors to perform the duties delegated by the Board. The person appointed as a Company Secretary must possess the required qualification to be able to perform the managerial, ministerial and administrative functions in an efficient manner. The documents become legally binding if its signed him on behalf of the company.

Appointment of Company Secretary

According to Section 2(1)(c) of the Company Secretaries Act, 1980 states the one basic and essential qualification of the Company Secretary should be a member of the Institute of Company Secretaries of India.

Provisions for Appointment of Company Secretary

Qualification of Company Secretary

I) Professional Qualities

Company Secretary shall possess the following qualification are as follows-

a) General Knowledge
b) Educational qualifications in areas such as management, finance, cost, administration, cost secretaryship or secretarial practices etc.
c) Knowledge of industry and trade.
d) Knowledge of laws affecting the business.
e) Knowledge of economics, banking, etc.
f) Experience as a Company Secretary
g) Drafting capacity
h) Great personality
i) Organizing capacity
j) Any other desirable business qualities.

II) Personal Qualities

Company Secretary shall possess the following personal qualities are as follows-

a) Sense of responsibility
b) Impressive Personality
c) Imagination Power
d) Sharp memory
e) Honesty
f) Foresightedness
g) Honesty
h) Intelligence
i) Maturity
j) Broadminded
k) Dynamic thinking
l) Cooperative
m) Sympathetic
n) Tactfulness
o) Courteous

Legal Position Of Company Secretary

According to Companies Act, 2013 a company secretary is an ‘officer’, ‘employee’, ‘agent’ or ‘servant’, of a company who is appointed to perform duties towards the company. He is considered to be a key managerial person who holds an important position in the family.

1) **As an Employee or Servant of the company**- A company secretary is considered to be a mere servant of a company. His duty is to perform the work as and when told. He has no authority and no one can assume his statement to be trustworthy without further inquiry. Apart from this, a company secretary has the full right to receive prior and proper notice in case of dismissal or damage in lieu thereof (In Bharat vs South London Tramways Co. 1887).
2) **As an Officer of the Company-** A secretary is considered to be a key managerial officer of the company but does not enjoy the same status or power as those of the Managing Director or Director in the company. He is merely an officer who is appointed to perform the work under Board. Apart from this if the secretary tries to go beyond the powers or found guilty of misconduct or negligence he shall be held liable and punishable with penalty or imprisonment as the case may be.
3) **As an Agent of the Company**- A company secretary act as an agent of a company in a limited sense. He has the right to enter into a contract on behalf of the company. Being an agent he has the right to sign the documents of the company that does not require the common seal of the company. He has the right to represent the third party on behalf of the company. He also assists and advises the Board of Directors. He also acts as an advisor to different parties on behalf of the company in matters relating to company meetings, forfeiture of shares, payment of dividend, payment of interest, execution of the agreement, contracts and regulations,

Rights of Company Secretary

The rights of the Company secretary can be defined by the Boards of Directors or stated in the Companies Act, or the general meetings of the shareholders. Following are the rights of the secretary-

a) To carry out the work delegated by the Board of Directors.
b) To represent the company on its behalf to the third parties.
c) To prepare the minutes of the company and sign it and various other documents of the company that does not require a common seal.
d) To control and supervise the office work at the registered office.
e) It is the right of the secretary to be provided with proper termination of his service. In case, if he is not provided with a proper dismissal or termination he has a right to claim for damages from the company.
f) To receive a salary in the normal course of his services rendered.
g) To accepts or rights bills of exchange when authorized by the Board of Directors.
h) Itôs a right to carry the acts as stated by creditors.
i) Right to call meetings
j) The right to send allotment of shares.
k) To correspond towards calls on shares, the transmission of shares or forfeiture of share etc.
l) The right to receive expenses in case of wrongful removal of the amount spend on pleading his case.

Duties of Company Secretary

As per Rule 10 of the Companies (Appointment and Remuneration of Managerial Personnel) prescribe the duties of the Company Secretary they are as follows-

1) The Company Secretary shall provide guidance to the directors either individually or collectively as and when they require with regards to their powers and responsibilities.
2) To arrange meetings apart from various meetings such as Board meetings and general meetings.
3) To maintain the minutes of the meetings.
4) The secretary is required to work as per the Companies Act 2013, for this, they are required to take approvals from the government, Board of Directors and members of the general meeting in the matter concerned.
5) The secretary is responsible to represent the company before the third part. The Companies Act, 2013 authorizes the secretary to represent before regulators in connection with the discharge of various duties under the Act.
6) The secretary is responsible for assists the directors in the affairs of the company.
7) To assists the Board of Directors in complying with the corporate governance requirements.
8) Making an application to the Registrar for proposing the name of the company.
9) Assisting the directors the preparing and printing the Articles and Memorandum of the company.
10) Filing the necessary documents to the Registrar for the registration of the company.
11) Sending copies of the Memorandum and Articles of the company to the members on a request.
12) Advising and assisting the Directors in preparation of prospectus.
13) To sign and issue a certificate of shares after getting authorization from the Board.
14) Maintaining the record of the registers separately of members, debenture-holders, and any other security holders.
15) Filing and preparing the Annual Return to the Registrar.
16) Making proper arrangements for conducting company meetings and sending notifications and reminders to the members and the Board as and when required.
17) Preparing the minutes of the general meeting and making them open for inspection by any member.
18) Advising the Directors in matters related to declaration and payment of dividends.
19) As per the Companies Act, the secretary is responsible for assists the Board of Directors with respect to Corporate Social Responsibility (CSR).
20) To assists the directors in matters relating to the audit and auditors of the company.

21) Assisting the directors in matters relating to appointment and remuneration of managerial personnel.
22) Assisting and advising the directors concerning the matters with respect to acquisition, amalgamations, arrangements, and compromises.
23) Filing and furnishing the required information as and when required by the Registrar in case of an investigation.
24) Providing assistance in the preparation of the Auditorôs report or Corporate Government and Chairmanôs speech.
25) The secretary is also responsible for presenting the case or appeal before the Appellate Tribunal.

Liabilities of Company Secretary

The liabilities of a company secretary can be broadly categorized is as follows-

1) Statutory Liabilities

A company secretary is a ómanagerial officerô is entrusted with certain statutory liabilities under the Indian Companies Act, the Indian Stamp Act, Income-tax Act, Estate Act, MRTP Act, FERA Act etc. The secretary is expected to fulfill these mentioned duties with due compliance on the failure of which the secretary will be held liable and the punishment either in the form of imprisonment or payment of fine or both. Some important liabilities are listed as under-

a) For failure to file the Return of Allotment of Securities with Registrar: Penalty of Rs 1000 for every day till the default continues or 1,00,000 whichever continues. (Section 39)
b) Failure to transfer of securities without a proper instrument of transfer: Penalty of Rs Rs 10,000 extendable to Rs 1 lakhs. (Section 56)
c) Failure not registering the transmission or transfer of securities and not rectifying the register: Penalty Imprisonment of at least 1 year extended up to 3 years and fine of 1 lakhs to 5 Lakhs. (Section 58)
d) Failure to include a statement authorized, subscribed and paid-up capital on a notice: Penalty of Rs 5,000 for each default. (Section 60)
e) Failure to keep the ôRegister of Chargesô or any intimation with respect to the Registrar: Penalty, Imprisonment of 6 months or fine at least Rs 25,000 extendable to Rs 1 lakhs, or both. (Section 86)
f) Failure to maintain Register of Members, security holders, or the debenture-holders: Penalty: Rs 50,000 extendable to Rs 3 lakhs. (Section 88)
g) Failure to give prior notice to the Members, Security holder or Debenture-holders of at least 7 days before closing the Register: Penalty Rs 5,000 for every day Rs 1 lakhs for the time the register is kept closed. (Section 91)
h) Failure to file a copy of the Annual Return with the Registrar: Penalty of Rs 50,000 extendable to Rs 5 lakhs or Imprisonment for a term of 6 months or both. (Section 92)
i) Refusing the inspection of the Registers of Members, security holder or Debenture-holders and failure to issue extra copy on request: Penalty- Rs 1,000 for everyday extendable to Rs 1 lakhs for the time default continues. (Section 94)
j) Failure to hold Annual General Meeting: Penalty-Rs 5,000 for every day during which the default continues. (Section 99)
k) Failure to circulate members' proposed resolution or any statement with respect to such resolution: Penalty- Rs 25,000. (Section 111)
l) Failure to file a copy of agreement or resolution with the Registrar within a specified period: Fine of Rs 1 lakhs extendable to Rs 5 lakhs. (Section 117)
m) Failure to prepare, sign the minutes of the meetings: Penalty of Rs 5,000. (Section 118)

n) Failure to send a copy of the financial statements, auditors report etc to every member of the company: Penalty of Rs 5,000. (Section 136)

2) Contractual Liabilities

Contractual liabilities of a company secretary arise out of service agreement entered into with the company. They are as follows

a) The secretary should be able to carry out the orders of the directions given to him.
b) To perform his contractual agreement with care and responsibility.
c) To be held liable in case of breach of contract of service.
d) To be held liable in case of misconduct and negligible on his part.
e) To be held liable in case of secret profit earned.
f) Not to keep trade secrets during the course of his employment with the company.
g) Not to perform any such act that goes beyond his powers (*ultra-vires)*

Functions of Company Secretary as per Companies Act 2013

As per Section 205 of the Companies Act, 2013 the functions of the Company Secretary are as follows-

a) To inform the Board of Directors from time to time about the various provisions that are mentioned in the Companies Act 2013, and various amendments that take place from time to time under the law applicable to the company.
b) To assure that the company acts according to the ósecretarial standardsô as per Companies Act. The term ósecretarial standardsô refers to the standards as per Institue of Company Secretaries Of India and approved by Central Government.
   Transparency, Better Compliance environment, timely communication, healthy corporate governance are some of the main purposes of secretarial standards.
   - SS-1: Meetings of the Board of Directors
   - SS-2: General Meetings
   - SS-3: Dividend
   - SS-4: Minutes
   - SS-5: Register and Records
   - SS-6: Transmissions of Shares and Debentures
   - SS-7: Passing of Resolution by Circulation
   - SS-8: Affixing of the common seal
   - SS-9: Forfeiture of Shares
   - SS-10: Boards of Report

WINDING UP OF COMPANIES

According to the Companies Act, the term Winding Up refers to the closing or finishing of a company. The company is an artificial person created by Law, having its own separate own identity. The process through which the life of a company comes to an end refers to as winding-up, Under which the affairs of the management are taken out of the directorôs hand and the company ceases to carry on its business.

In the process of winding up the liquidator is appointed who takes the charge of the company collects its assets, pays the debts and finally distributed the money so realized among the members in accordance with their rights. The winding-up also is known as óliquidationô in common parlance.

Characteristics of Winding Up

a) Winding up is a process.
b) The life of the company is ended.
c) In this process, the property of the company is used for the benefits of its members and creditors.
d) In order to realize the assets and properties of the company, a liquidator is appointed.
e) In case any surplus is left out it is then distributed among the members according to their rights.
f) Winding up does not only refer to that the company is only insolvent but it is generally wound up by the approval of members in general meeting.
g) There is a difference between dissolution and winding up.

Modes of Winding-Up

After the amendment of Sections 270, 271, and 272 of the Companies Act, 2013 through the Insolvency and Bankruptcy Code, 2016 (28th May 2016). At Present, the Company can only be wound ï up through Tribunal

I-Procedure for Winding Up of Company

Section 270, of the Companies Act, 2013 lays down the procedure for winding up of the company. The two ways of winding up are-

A)By the Tribunal- According to Companies Act 2013, a company may be wound up by tribunal in case-

i. If the company is unable to pay its debts.
ii. If the company is resolved by passing a special resolution by the Tribunal.
iii. It has acted against the integrity and sovereignty of India, the security of the state, public order, decency or morality.
iv. If the winding-up of the company is been ordered by the Tribunal under Chapter XIX.
v. If the company fails to file the financial statements for the preceding five consecutive financial years.
vi. If it is just and equitable for the Tribunal that the company should be wound up.

vii. If the company is found guilty of conducting the business in a fraudulent manner or formed for unlawful purposes.

B)Voluntary Winding Up of Company

The company can be wound up voluntarily by the members of the company if-

i. On passing the special resolution for winding up of the company.
ii. If a special resolution in passed in a general meeting for the winding up of the company on the expiry of the period of its duration or if it's fixed by the Articles of Association that the company needs to be dissolved.

II. Who may present the Petition for Winding Up?

Section 272, of the Companies Act, 2013 a petition to the Tribunal for the winding-up of the company shall be presented by any of the following persons:-

a) the company
b) the Registrar
c) any Contributory or Contributories
d) any person authorized by the Central Government

III.Power of National Company Law Tribunal

Section 273, lays down the power of the tribunal with respect to the petition for winding-up are as follows:

1) **Making an Order:** On receipt of the petition, the Tribunal may pass any of the following orders.
    a) Dismiss it, with or without costs,
    b) Make any interim order,
    c) Appointing a provisional liquidator till the making of a winding-up order.
    d) Make an order with or without cost for winding-up of the company.
    e) Any other order as it thinks fit.
2) **Refuse to make an order:** Where a petition is filed that the company should be wound up, then, in that case, the Tribunal has the power to refuse to make an order of winding-up of company, if according to him any other remedy is available to the petitioners.

IV-Direction for Filing Statement of Affairs

According to Section 274 of the Companies Act, 2013 if any person other than company file a petition for winding up before the Tribunal, then in that case if the Tribunal is satisfied *prima facie* for winding ï up then an order is made by the Tribunal to wind-up the company along with the statements of its affairs within 30 days of the order in such form and in a manner as may be prescribed. However, if the Tribunal thinks fit he can also extend the period of 30 days in special situations or circumstances.

V-Company Liquidator and their Appointment

Section 275(1), states that the Tribunal at the time of passing of the order for the winding-up of the company shall appoint the Official Liquidator from the panel under Section 275(2) as the Company Liquidator.

VI-Jurisdiction of Tribunal

Section 280, lays down Jurisdiction of the Tribunal. In which the Tribunal has the authority to entertain or dispose of the following matter:-

i. Any suit by or against the company
ii. Any claim by or against the company
iii. Any application under Section 233 with respect to the merger or amalgamation of certain companies for instances- small companies, wholly-owned subsidiary company or holding company etc.
iv. Any question of law including those relating to benefits, duties, obligations responsibilities or any manner relating to the winding-up of the company.

VII-Submission of Report by Company Liquidator

According to Section 288, the Tribunal shall appoint a Company Liquidator who shall make periodicals report at the end of each quarter with respect to the progress of winding-up of the company. On receiving the application in a manner as may be prescribed by the Company Liquidator the Tribunal shall make necessary modifications as it thinks fit.

IX-Settlement of List of Contributories and Application of Assets

Section 285 of the Companies Act, 2013 states that as soon as after passing the order of the winding-up. The Tribunal shall settle the list of contributors and cause rectification in the registers of the members in accordance with the Act.

X- Power and Duties of Company Liquidator

Section 290 lays down the powers and duties of a Company Liquidator as directed by the National Company Law Tribunal:-

i. To carry the business for a time period as far as it is beneficial for the company.
ii. To carry all the acts in the manner as may be prescribed and on behalf of the company, receipts the documents, do all the deeds, and to use the companyôs seal as and when necessary.
iii. To sell the property either movable or immovable by public auction or by private contract, with power to transfer such property to any person or body corporate.
iv. To sell the whole of the companyôs undertaking as a going concern.
v. To raise money that is used for the security of the assets of the company.
vi. To institute or defend any suit whether civil or criminal in the name or on behalf of the company.
vii. To settle the claims of the creditors, employees and distribute it in accordance with the priorities stated under this Act.
viii. To inspect the records and file the records to the Registrar.
ix. To accept, draw r endorse any negotiable instruments like hundi, bills of exchange or promissory note in the name or on behalf of the company.
x. To appoint professional assistance in the discharge of his duties, responsibilities and to protect the assets of the company.
xi. To secure a loan by mortgaging the property of the company.
xii. To appoint a legal advisor or advocate that can assist him in connection with the discharge of his duties.
xiii. To prove and claim an insolvent contributory for any balance against his estate.
xiv. To arrange and call the meetings of the creditors to discuss the matters related to the process of winding-up.
xv. To check the records and returns of the company.

XI-Dissolution Of Company By Tribunal

The Companies Act, 2013 discuss the following provisions below:-

a) **Application filed for dissolution of Company by Company Liquidator**- Section 302 states that the Company Liquidator shall make an application to the Tribunal for the winding-up in the case where the affairs of the company completely wound-up.
b) **To make an order for dissolution-** Section 302 states that if the Tribunal is of the opinion that it just and equitable that an order for the dissolution needs to be made. Then in that case, the Tribunal shall make an order, then from the date of that order, the company shall be dissolved accordingly

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For the students of

B. Com. (Hons), Sem: IV

Name of Paper: Management Accounting

Prepared by: Dr. Ankita Sajjan

Accounting for managerial decisions – Fixation of selling price

MARGINAL COSTING: A TOOL FOR DECISION-MAKING

As Management accounting assist in the process of managerial decisions, the profitability of two or more alternative options is compared and such option is selected which offers maximum profitability along with fulfilment of objectives of an enterprise.

Though there are number of accounting techniques for such comparison and decision-making, marginal costing and differential costing have their significant role.

MAIN AREAS OF DECISION-MAKING AND APPLICATION OF MARGINAL AND DIFFERENTIAL COSTING

Marginal costing is a very useful technique in solving various managerial problems and contributing in various areas of decisions:

(I) Pricing Decisions,

(II) Exploring a New Market,

(III) Make or Buy Decision,

(IV) Change in Product Mix,

(V) Shut-down Decisions.

1. Fixation of Selling Price

Although prices are regulated more by market conditions of demand and supply and other economic factors than by the decisions of management, the management while fixing prices has to keep in view the level of profit desired. In the long-run, the selling prices of products or services must be higher than the total cost as otherwise the profit cannot be earned. But frequently circumstances arise for management to consider special conditions and sell its regular product at a special price which may be lower than the total cost. Fixation of selling prices is discussed below:

(a) Under normal circumstances.

(b) In times of competition and/or trade depression.

(A) Selling Prices under normal circumstance

In the long run, under normal circumstances, the selling price must cover total cost (i.e., variable cost plus fixed cost) and also give a reasonable amount Profit. This is essential for the survival of a business.

In the short run due to adverse market conditions, the selling price may have to be fixed below total cost but it should be above variable cost. In other words, the selling price depends upon cost plus contribution basis and the amount of contribution on demand and supply, acuteness of competition, non-cost factors etc. But it should be noted that fixation of rice below total cost may be made only on a short term basis.

(B) Pricing in competition and depression

In case of competition or in periods of depression, products may have to be priced below total cost, if such a step necessary to meet the special situation. When variable cost technique is used for pricing, the price should be higher than the variable cost so that it makes a contribution towards fixed cost and help reduce the loss

if selling price is just equal to variable cost, the amount of loss will also be equal to the amount of fixed cost because in such situation the selling prices makes no contribution towards fixed cost.

Practical Problem (solved)

Fixed cost	Rs. 1,00,000 (total)
Variable cost	Rs. 7 per unit
Current market price	Rs. 8 per unit

Output	50,000 units

Should company sell or not?

Solution

Variable cost (50,000 units @ 7)	Rs. 3,50,000
fixed cost	1,00,000
Total cost	**4,50,000**

cost per unit = 4,50,000 + 50,000 units = Rs.9

Although the selling price does not cover the total cost, yet it is wise to continue to produce and sell because such a step will reduce the loss (on account of fixed cost) that will be incurred if production is stopped. If production is stopped, the loss would be (the amount of fixed cost), but if production is continued the loss will be as follows:

Sales (50,000 units @ 8)		Rs. 4,00,000
Less: Total cost (Marginal cost + Fixed cost)		Rs. 4,50,000
	Loss	**Rs. 50,000**

Thus, by continuing to produce and sell at below total cost, the loss is reduced by 50,000 i.e. from Rs. 1,00,000 to Rs. 50,000.

- **Special Circumstances when Selling Price is Below Variable Cost**

When selling price falls below variable cost, the loss will be more than the amount of fixed cost. In such an eventuality, it will be better to stop production so as to reduce the amount of loss because stoppage in production means loss will be just equal to fixed cost.

However, in certain special circumstances like the following, production may be continued even if the selling price is below the marginal cost.

1. To popularise a new product. A new product introduced in the market may be sold at a very low price so as to make it popular.

2. To eliminate competitors from the market.

3. To dispose of perishable products so as to avoid total loss.

4. To export so as to earn foreign exchange. Government may allow import quota against foreign exchange earnings and profit from import quota may be more than the loss on exporting the product at low prices.

5. To keep plant and machinery in operation as idle machines may be liable to deterioration.

6. To prevent loss of future orders as temporary closure may bleak business connections with customers that can be re-established at a heavy expenditure.

7, To help in the sale of a conjoined product which is making large profits.

8. To maintain production and to keep employees occupied.

Accounting for managerial decisions – Make or Buy

MAKE OR BUY DECISION:

`Make or Buy Decision' is a problem in respect of which management has to take decisions continuously. In this context, the management has to decide whether a certain product or a component should be made in the factory itself or bought from outside suppliers.

Marginal cost analysis renders useful assistance when a decision has to be tempted to buy a taken by the management on whether a component part should be manufactured component from internally or purchased from an outside firm. Insourcing is producing the goods the market When by the firm itself whereas outsourcing is the process of purchasing the goods or own cost Of services from outside suppliers. For example. a car manufacture may rely on production is more than the market outside vendors to supply some component parts but chooses to manufacture other parts internally.

This is particularly so when a component part is available in the market at a Price below firm's own total cost. This type of decision based on total cost analysis may be misleading. Such a decision can be arrived at by comparing the outside supplier's price with firm's own marginal

cost. On the face of it, since the only cost to manufacture the component is its marginal cost, then the amount by which marginal cost falls below supplier's price is the saving that arises in making. Therefore, it will be profitable to buy from outside only when supplierôs price is below firm's own marginal cost.

For example, total cost of making a component is 100 per unit, consisting of 80 as variable cost and 20 as fixed cost. Suppose, an outside firm is prepared to supply this component at 90, it may appear that it is cheaper to buy the component. But a study of cost analysis will show that each if manufactured makes a contribution of 20 towards recovery of fixed cost. This fixed cost has to be incurred whether we make or buy. The real cost of making the component part is only 80 which is its variable cost. This offer of 90 per unit should not be accepted because if accepted, the component will really cost 110, i.e., 90 of purchase price plus 20 of fixed cost which cannot be saved if component is not produced.

However, before arriving at final decision, due consideration should be given to other factors. For example. it should also be considered as to whether plant capacity released by the non-manufacture of the component part is put to some alternative use or not.

The nature of decision regarding make or buy may be of the following types :

(a) Stopping the production of the part and buying it from the market :

A business concern is already making a part or component which is used in the business. Now due to some reasons, a decision has to be taken whether this part or component should be bought from the market or additional requirement due to increase in production of main factory should be made in the factory or should be bought from the market. In the case of a decision like stopping the production of

the part or component and buying it from the market, a comparison of marginal cost of such production with that of buying price should be made. It is to be remembered that there would not be additional fixed costs in such a case and only marginal cost is the relevant factor to be considered. If the marginal cost is less than buying price, additional requirement of the component should be met by making rather than buying. Similarly, if buying price is less than marginal cost, it will be advantageous to purchase it from the market.

(b) Stopping the purchase of a component and to produce it in own factory :

Another aspect of the problem of 'make' or 'buy' may be that a component or part thus far being purchased from the market should be produced or made in the factory or not. In this case, normally some extra arrangements regarding space, labour, machines, etc. will be required. This may involve capital investments too. Some special overheads may also be necessary. If the decision for making requires the setting up of a new and separate factory, separate supervisory staff may also needed. All these arrangements will require additional costs. As such, the price being Paid , outsiders (suppliers of the component) should be compared with additional costs which will - have to be incurred in the form of raw materials, wages, salaries of additional supervisors, interest on capital investments, depreciation on new machines, rent of premises, etc. If such additional costs are less than the buying price, the component should be manufactured and vice versa.

It may be mentioned that the above technique is based on cost data only. However, some non-cost factors are also required to be taken into account, such as :

(i) There should be no compromise in respect of quality. If quality cannot be ensured in 0%, production, the item concerned should be purchased from outside. Similarly, if outside supplier, cannot be relied upon in respect of quality, the item should be produced by the firm whatever be the cost.

(ii) If decision of purchasing seems to be profitable, the reliability of regular supply should definitely be ensured.

(iii) If there are large fluctuations in demand, it is better to purchase from outside. However, if the demand is likely to increase substantially, own production may be preferred because it will lead to lower cost in future.

(iv) If decision to purchase from outside supplier seems profitable, the general reputation enjoyed by supplier for reliability, his financial position, production facilities, etc. should also be considered properly.

Practical Problem (solved)

A radio manufacturer finds that while it costs Rs. 6.25 per unit to make a component and the same is available in the market at Rs. 5.75 each. Continuous supply is also fully assured. The break-down of costs is:

	Per unit (Rs.)
Materials	2.75
Labour	1.75

Other Variable Expenses	0.50
Depreciation & Other Fixed Costs	1.25
	6.25

a. Will you make or buy?

b. What would be your decision, if the supplier offered the component at 4.85 per unit?

Solution

Case (a) : Marginal Cost of 'Making'

	Rs.
Materials	2.75
Labour	1.75
Variable Expenses	0.50
Cost of Buying	**5.75**

Thus, buying will not be profitable and component should be manufactured.

Case (b)

	Rs.
Marginal Cost of `Making'	5.00
Cost of Buying	4.85

Savings when bought **0.15**

Decision: In this situation manufacturing will not be profitable and it will be profitable to buy it.

- **Outsourcing and Idle Capacity.**

When a firm has no spare capacity and manufacturing a component involves setting aside other work, the loss of contribution of displaced work should also be given due consideration. In other work, it will be profitable to buy only when the purchase price is below variable cost plus loss of contribution of displaced work. The loss of contribution is usually best found by the use of contribution per unit of key factor.

In make or buy decisions, opportunity cost may have to be considered.

Non-cost or Qualitative Factors.

While making a decision on make or buy a component, the following non-cost factors should also be considered.

(a) Assurance of continued supply, if bought from outside.

(b) Assurance of quality of the product by the supplier.

(c) Assurance of no price increase during the period of agreement.

Questions to solve:

Question 1:

XYZ Cycles Ltd. purchases 20,000 bells per annum from an outside supplier at Rs. 5 each. The management feels that these should be manufactured and not purchased. The following relevant information are available:

Material Cost per Bell

Labour Cost per Bell

Variable overheads per Bell 100% of Labour Cost

Fixed cost per Bell

You are required to advise whether:

(i) The company should continue to purchase the bells from the outside supplier or should make them in the factory, and

(ii) The company should accept an order to supply 5,000 bells to the market at a selling price of Rs. 4.50 per unit.

Question 2:

Manufacture of product A takes 20 hours on machine No. 1 . It has a selling price of 150 and marginal cost of Rs. 110. Component part Y could be made on machine No. 1 in 4 hours. The marginal Cost of component part is Rs. 9 of which outside supplier's price is Rs. 15.

Should one make or buy component Y?

Discuss in both situations when—

(a) Machine No. 1 is working at full capacity.

(b) There is idle capacity.

Question 3:

A radio manufacturing co. finds that while it costs 6.25 to make component R-518, the same is available in the market at 5.75 each, with an assurance of continued supply. The break-down of the cost is:

Materials	Rs. 2.75 each
Labour	Rs. 1.75 each
Other variables	Rs. 0.50 each
Depreciation and other fixed costs	Rs. 1.25 each
	Rs. 6.25

(a) Should you make or buy?

(b) What would be your decision, if the supplier offered the component at 4.85 each?

Accounting for managerial decisions –Exploring new market

EXPLORING NEW MARKETS

Sometimes, a company is not able to fully utilise plant capacity when selling at total cost plus profit basis. In such a case, it may explore new markets and find opportunities to receive additional bulk order or export order at a price which may be below total cost but above variable cost so that the price makes a ǿcontribution'. The entire amount of contribution form such sales is profit because fixed cost is already recovered from current sales at total cost plus profit basis. Such additional sales at below total cost is possible only because in accepting bulk orders and export sales, price discrimination is possible. In this way spare plant capacity can be utilised to earn additional profit.

Additional Order for Utilising Spare Capacity

When a company has a spare (or idle) capacity which it is not able to utilise because of sales constraint and it receives a bulk order at below normal selling price, such an order should be accepted, provided existing sales are not affected by price discrimination. It will earn the company additional profit, by utilising spare capacity.

Practical Question (solved)

A manufacturer of plastic buckets makes an average profit of 2.50 per piece on a selling price of 14.50 by producing and selling 60,000 pieces at 60% of potential capacity. His cost of sales is:

	Rs. Per Piece
Direct materials	4.00
Direct wages	1.00
Factory overhead (variable)	3.00
Selling overhead (variable)	0.25
Total fixed cost is	2,25,000

During the current year, he intends to produce the same number of units, but anticipates that

(a) cost will go up by 10%, and

(b) material and labour costs will go up by 5% each.

under these circumstances, he obtains an offer for a further 20% Of his capacity. What minimum price You would recommend for acceptance to ensure an overall profit of Rs. 1,60,000.

Solution

Budgeted Statement for the Current Year Prior to Acceptance of 20% Capacity Order

	Per Piece (Rs.)	Total (Rs.)
Sales (60,000 pieces)	14.50	8,70,000
Direct material (Rs. 4 + 50/0)	4.20	2,52,000
Direct labour (Rs. 1 + 5%)	1.05	63,000
Variable factory overhead	3.00	1,80,000
Variable selling overhead	0.25	15,000
Variable cost	8.50	5,10,000
Contribution (Sales - Variable cost)	6.00	3,60,000

Fixed cost Rs. 2,25,000 + 10% = Rs. 2,47,500

Profit = Contribution - Fixed cost

= 3,60,000 ï 2,47,500 = Rs. 1,12,500

Planned profit = Rs. 1,60,000

Increase in profit (or contribution) required = 1,60,000 ï 1,12,500 = Rs. 47,500

Variable cost of additional 20,000 pieces (order

for 20% capacity, i.e., 20,000 x 8.50) = Rs. 1,70,000

Add: Additional contribution desired = Rs. 47,500

Total sales value = Rs. 2,17,500

Selling price per unit = Rs. 2, 17,500 + 20,000 units = Rs. 10.875

Thus, minimum price for sale of additional 20,000 units is 10.875 so as to ensure an overall profit of Rs. 1,60,000

- **Export Sales**

  Additional orders may be accepted from a foreign market at below normal below total cost but price or below total cost but above marginal cost. Export sales yield additional contribution when such sales are at a price which is above variable cost.

  While determining profitability of accepting export orders, the following additional factors should be considered.

  1. Export sates may result in additional costs like special packing cost, additional quality checks, freight and insurance charges, etc., if not borne by importer. These costs should be deducted from contribution to determine profit from export order.

  2. Export sales may result in certain cost benefits like export subsidy from government, exemption or concessions in excise duty or duty drawbacks, etc. In determining profit from export order, these items should be deducted from cost or added in contribution.

For the students of

B. Com. (Hons), Sem: IV

Name of Paper Organizational Behaviour

Prepared by: Deepak Verma

Perception: Meaning, Significance of Perception for understanding Human Behaviour

Learning Objective

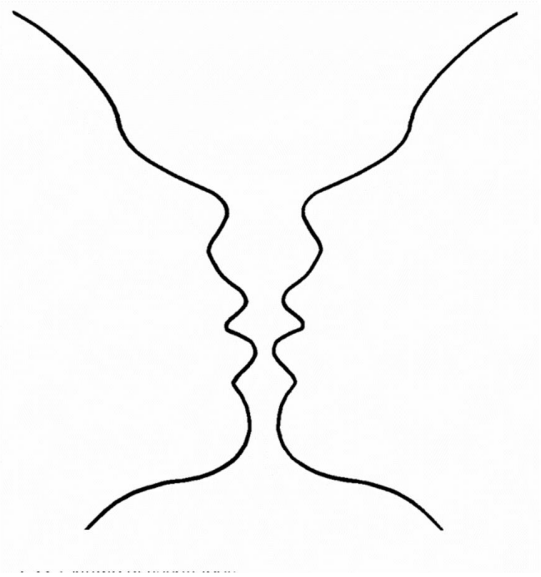
- Understand the meaning and concept of perception.
- To know the importance of the perception process, form the organization's point of view.

1. Introduction

Perception is like the popular saying; beauty is that lies in the eyes of the beholder. Individual opinion varies in the way he or she sees, interprets, analyses and understands a event. A manager may have different perception about the welfare programme being offered by the organization and employees may have a different perception. This difference develops because of an individual's values, beliefs, and attitude.

The attitude of an individual is a way of thinking. It may be positive or negative. While the perception is the outcome of this thinking. Individuals may different opinions through the event or situation may be the same. For example, in an organization where lunch is served in a subsidized manner may be interpreted by the employees in a different way. For example, if management is providing free transport services to their employees, there may be different perceptions. Employees may think that this is their right to have such facilities, other may think that employer is thinking about their betterment to keep employees away from hustle and bustle of city traffic. Management may have different perception here about the free transport services like, to avoid any kind of accident while employees are travelling to the organization or leaving for their homes. If any accidents occurs under such circumstances, employers are liable to pay heavy compensation to the deceased employees. Apart from that employees would reach at the workplace at the time.

Every day we are experience the countless objects, events or person but we retain few stimuli and reject others. The different person received these stimuli and analyses them in a different way. What is the reason behind this phenomenon? The answer to the question is the perception. Perception is a psychological process which affects the human behaviour because perception determines the way the individual experiences the situation as per his or her past experiences, values, believes, attitude etc.



(Figure 7.1: Perception may differ person to person)

Figure 7.1 explains the concept of perception very well. On seeing the picture one can say it's depicting like two human face while another individual may say that it's a cup.

2. Meaning and Definition of Perception

Perception can be understood as the process through which information or stimulus is received by the human brain from the environment and then to select, organize and analyse the situation to bring any meaning out of it. Internal and external factors are important to influence the perception of any individual. The meaning of perception can be better explained with the help of definitions given below:

Joseph Reitz, "Perception includes all those processes by which an individual receives information about his environment- seeing, hearing, feeling, tasting and smelling.

Robert A Baron, "perception is concerned with identifying the processes through which we interpret and organize sensory information to produce the conscious experience of objects and object relationship."

Robbins defined perception as "a process by which individuals organize and interpret their sensory impressions in order to give meaning to their environment.

With the consideration of the above definitions, the perceptual process is affected by three classes of variables-the objects or events being perceived, the environment in which perception occurs and the individual doing the perceiving.

Perception can be explained as a process in which individuals gather and interpret their sensory stimuli in order to give meaning to their environment." Therefore, in simple words, perception can be described as the process making point of view about any situation, objects or person on after receiving audiovisual stimuli.

3. Features of perception

Perception has the following features:

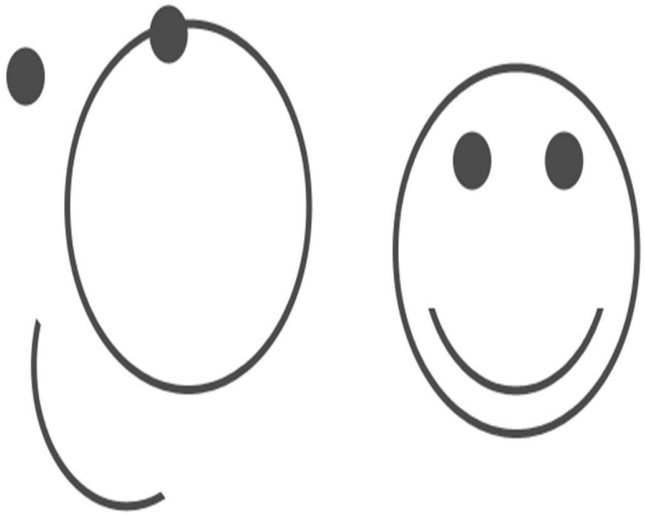
a. Perception is individual response according to one's own sensory process.
b. It is a subjective process which differs people to people and situation to situation.
c. Perception is a filtering process where an individual selects the sensory information according to his or her choice to make any point of view.
d. Perception represents seeing the reality in different ways by a different individual. Interpretation of the situation depends upon the expectation and interests of what one wants to see.
e. People show different types of behaviour based on the perception they have about any situation or any person.

4. Concept of whole

The term 'Gestalt' is a German word that means 'seeing the whole picture all at once. Gestalt psychology is an effort to understand the principle behind the ability of the human mind to acquire and maintain meaningful perceptions in an apparently disordered world. This concept can be demonstrated by a dog picture, which depicts a dog sniffing the ground in the shade of a tree. The dog is not recognized by first identifying its body parts (feet, ears, nose, tail, etc.), and then concluding the dog after analysis and making sum (total) of those body parts. Instead, the dog appears as a whole, all at once when we see the picture. It may also possible that the shadow which is depicting like a dog to some individual may be perceived something else by another individual.

There is a famous phrase of Gestalt psychologist ***Kurt Koffka*** *as,* "the whole is something else than the sum of its parts".

This theory suggests that the whole of an object or scene is more significant than its individual parts. Observing the whole helps us finding the order in chaos and unity among unrelated parts and pieces of available information.



(Figure 7.2: Gestalt concept of the whole)

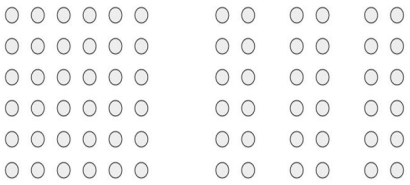
5. Perpetual organization

- According to Gestalt psychology, the whole is different than the sum of its parts.
- Based upon this concept, Gestalt psychologists established a set of principles to explain perceptual organization, or how smaller objects are grouped to form larger ones.

These principles are often referred to as the "laws of perceptual organization."

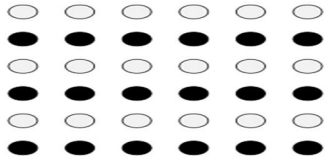
- **The Law of Proximity**: Stimulus elements that are closed together tend to be perceived as a group. The principle of proximity entails that individuals tend to perceive the objects placed

together as one group. The employees who are working in the same department at the workplace are perceived as one group because of geographical proximity.



(Figure 7.3: the law of proximity)

- **The Law of Similarity**: Similar stimuli likely to be grouped, this tendency can even dominate grouping due to proximity. The principle of similarity entails that objects of similar shape, colour or size tend to be grouped together.



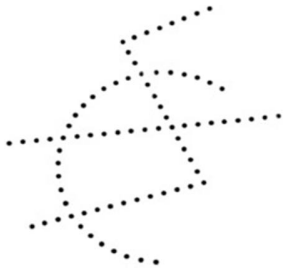
(Figure 7.3: the law of similarity)

In an organization employee having similar designation are seen as one group.

- **The Law of Closure**: Stimuli are tended to be grouped into whole and complete figures. The principle of closure entails the tendency to perceive the object as a complete even when some parts of it are missing. Most people can guess the word only by seeing initial and last letters of the word.

(Figure 7.3: the law of closure)

- **The Law of Good Continuation**: Stimuli tend to be grouped as to minimize change or discontinuity.



(Figure 7.3: the law of good continuation)

- **The Law of Symmetry**: Symmetrical boarders tend to be perceived as coherent figures.

(Figure 7.3: the law of symmetry)

- **The Law Simplicity**: Simple looking stimuli or stimuli easy to understand usually looks like one unit.

(Figure 7.3: the law of simplicity)

6 Nature

- Perception is fundamentally interpretation of the **sensory information** which involves understanding the stimulus received from the environment.

- It is inferred by **physiological as well as psychological characteristics** of an individual because perception not just involves receiving the stimulus from the sensory organs of a human being like eyes, ears, skin, nose, tongue but, it is much more than that.
- Perception is formed when the **stimulus received is organised in a particular manner** and then interpreted to have an idea about what is happening in the environment.
- Perception is a **subjective process because different individuals may perceive the same environment**, object or person differently on the basis of what stimulus they select from the environment, the manner they organise and interpret the information in order to understand the situation.

7. Significance of perception

Significance or importance of the perception can be understood from the following points:

Perception is important to understand individual behaviour in any situation. Every individual perceives the surroundings differently and thus, understanding the perception **helps us finding out that why every individual behaves in a particular manner**.

With the help of knowledge of perception process, we can easily **predict that how people would react** to any situational change in an organization.

Perception helps a manager in understanding human behaviour because people behave as they see the facts or environment. To control the behaviour of people, managers should understand their attitude and perception. Every person perceives the world and approaches the life problems differently.

With the help of understanding perception, the needs of various people can be determined, because people's perception is influenced by their needs.

8. Summary

If there is a glass half-filled of its full capacity, some may say the glass is hall filled and some may say that the glass is half empty. This way of thinking is known as the perception of any individual about any object, person or situation. We may like some person because of their bonding with us but the same person may be hated by others. Personal values believes and attitude helps any individual to develop

any perception. Sensory organs of any individual help him or her to accumulate the information related to the surroundings and then on the basis of the nature of stimuli, need of the individual, past experiences individual make any perception. Understanding the perception process for the managers in very crucial these days because with the help of proper understanding of perception process managers can control the behaviour of the employees and can increase the effectiveness of the organization.

Perception Process and Factors influencing perception

Learning Objective

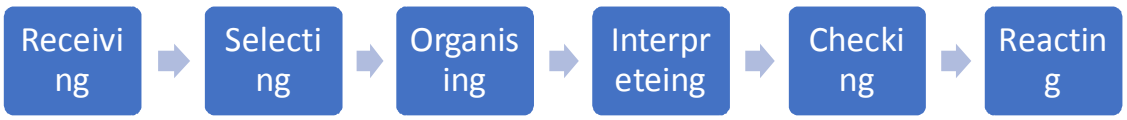
- Understand the perception process.
- Analyze the factors influencing the perception of the individual.

1. Introduction

In the previous chapter, we have had a fair idea about the meaning, nature, and importance of the perception in an organization. Under this chapter we will be discussing the process of the perception process along with the various factor affecting the perception process of an individual. It is also crucial to understand the scope or use of perception in organizational setup.

2. Perceptual Process

If we closely observe the various definitions discussed in the previous chapter it is clear that the perception process is about receiving, selecting, organizing, interpreting, checking and reacting to stimuli. The process is usually influenced by various factors like internal and external factors of individual, situation, past experiences etc. The process of perception can be understood with the help of the following the figure.



(Figure 8.1: Perception process)

A. Receiving

There are five sensory organs in the human body: eyes, ears, nose, tongue, and skin. These sensory organs help in receiving various stimuli from the environment in the form of vision, sound, smell, touch, and taste. These stimuli come from the external environment and help us to be safe form any potential danger. These stimuli also help us make our point of view about the surrounding as well. This process is called as receiving of the stimuli. This phase is considered the first step in the process of perception.

B. Selecting

There are many things occur in the surrounding of the individual. People only give attention to the incidents which are closely associated with them. The second phase of the perception process is selecting the right stimuli by the individual. The following factors affect the process of selecting stimuli from the environment:

I. **External Factors:** External factors influencing selection are the following:

a) *Size:* Size always brings the attention of an individual. Usually, bigger objects are more likely to catch attention than the smaller objects.

b) *Intensity:* intensity is a phenomenon related to light and sound. Very bright light, loud sound, strong smell attracts the attention.

c) *Repetition:* Repeated stimuli draw more attention. Instruction being repeated again and again affects more to the employees.

d) *Contrast:* Things which look different from others in a cluster, attracts more attention to any individual.

e) *Movement*: moving objects attract the attention more instead of stationary objects.

II. **Internal Factors:** Internal factors influencing the process of perception are:

a) *Learning:* Learning is a permanent change in the behaviour of an individual. These changes come from personal past experiences or going through the experiences of others. This cognitive factor which strongly influences the process of perception.

b) *Needs*: Needs also play an important role in the process of perceptual selectivity. A thirsty person will always be inclined towards the sources of water and a hungry person will always look around the eating points everywhere. A person who has a high need for an association or social needs will always join the group of his friends in the leisure time and the person with a high need for achievement will tend to work hard even in the leisure time to accomplish his goals.

c) *Age:* Age is an important factor while selecting the stimuli coming from the surrounding. Senior people have their own past experiences and always consider those experience. Young people seek more adventure and risks.

d) *Interest:* Perception is also influenced by the interest of the individual. A human resource expert will look the organization from the perspective of human resources issues only while an accountant will look for the financial issues of the organization.

C. Organizing

After receiving or accumulating and selecting the stimuli from the surrounding, the data received must be organized in a particular manner so that a meaningful perception can be created. This process of organizing the information into a meaningful whole or complete is called the perceptual organization. This process is completely a cognitive process and follows the below-mentioned principles:

I. **Figure and Ground*:*** This principle is mentioned as the basic form of organizing the perceptual set. This principle simply states that the object or event or person which is being perceived stands out from its background. If we closely observe below-mentioned figure, there may be tow perception here either (black figure) two faces or a cup (white) if we fix our perception on the glass, we will see the glass in the figure all the time or vice versa.

(Figure 8.2: principles of figure and ground)

II. **Perceptual grouping**: Perceptual grouping has been discussed in details in the previous chapter. Perceptual Grouping is defined as the tendency to group the stimuli into some meaningful patterns. The grouping includes similarity, proximity, closure, and continuity.

III. **Perceptual defense**: This principle entails that individuals tend to make a defense against the stimuli which are conflicting, threatening or unacceptable. The defense may assume the four possible forms:

(a) Outright denial,

(b) Modification of data received,

(c) Change in the perception but refused to change,

(d) Change in the perception itself.

Perceptual defense occurs due to individual values, believes, culture religion or personal interest and likings.

D. Interpreting

Perceptual interpretation is fourth and an essential part of the perceptual process. After the selection and organization of the stimuli, perceiver interprets the information in order to assign meaning to it. Actual perception starts when the gathered information is interpreted to something meaningful. There are following issues related to interpretation.

I. ***Perceptual set****:* Previously held beliefs or experiences about an object affects the individual's perception of similar objects.

II. ***Stereotyping:*** Stereotyping is the tendency of judging someone on the basis set of values and believes of the group to which he belongs. Like in Indian society it is believed that females are weaker than males and this is the reason that at most of the workplace many managers still hesitate to hand over the completed projects to the female employees.

III. ***Halo Effect****:* It is the tendency of perceiving others on the basis of a single trait or characteristics which may be good or bad, favorable or unfavorable. Sometimes, we judge the person on the basis of one first impression. In contemporary management practices, a concept is being popularly known as the hell effect. Now tendency of perceiving others on the basis of the good single trail is called a halo effect while perceiving on the basis of a bad or negative trait is called as hell effect.

IV. ***Projection:*** Projection is the tendency of associating own attributes to the others. It is easy to evaluate others if we assume that they are like us. A manager who is honest would like his employees to be honest as well.

V. ***Implicit personality theory:*** when we associate any independent factor with another independent factor of personality is called implicit personality theory. For example, honesty is associated with hard working at any workplace.

VI. ***Selective perception****:* Individuals have the tendency to select certain objects from the environment which they find relevant to their existing beliefs and values.

VII. ***Attribution:*** attribution theory refers to the concept that there is a reason for anything being done by an individual at the workplace. This reason may be internal or external.

E. Checking

Once the information is received, selected, organized and interpreted, the perceiver checks whether his interpretation of the information is right or wrong. These decision-making process is based on personal values and believes in daily routine life while professional ethics in the professional life at the workplace.

F. Reacting

The reaction of any individual can be understood with the help of SOBC model. SOBC model says that **stimuli** are received by the **organism (people)** then organism reacts to this stimuli and shows some **behaviour**. This behaviour being shown by the individual would have some **consequences.** Reacting phase is the last stage of the perceptual process. The perception process ends up when perceiver is indulged into some action in relation to the perception.

6. Factors Influencing Perception

The perception process is influenced by the factors of the perceiver, perceived and the situational factors. These factors are briefly explained as below:

I. **Characteristics of perceiver:** An individual's past experiences, needs, habits, personality, values, and attitudes affect the perceptual process. If someone is having a negative attitude will perceive or find out negative factors everywhere.

II. **Characteristics of perceived**: Physical attributes, appearance, and behavior also affect how they are (any object or people being perceived. Physical attributes of any objects or people such as age, gender, height, and weight affect the way the person or object is being perceived. Perceivers tend to notice physical appearance or characteristics under the perception process

discussed above in the chapter that contrast with the norm, that is intense, or that are new or unusual. Physical attractiveness usually catches the attention of perceiver quickly. During the interview, well mannered, attractive, well-dressed candidates have higher possibilities of being selected.

III. **Characteristics of the situation:** The physical, social and organizational settings of the surrounding also influence the process of perception. A conversation at the workplace may be perceived as a formal meeting with high credibility while meeting or conversation being done at public places may be perceived as an informal meeting.

7. Perception and human behaviour in the workplace

Understanding and implementation of perception are very crucial to managing the workforce in contemporary organizational setup. Perception reveals the picture of the environment and surrounding which may or may not differ from the reality. Identifying the difference between perception and reality is very important in an organizational setup.

In an organization setup perception can be used during talent acquisition (Job and exit interviews), performance management and employee motivation etc.

8. Summary

Perception process is a combination of various phases like receiving the stimuli, selecting the stimuli for further process, organizing the received information, interpreting the information, checking or evaluating the decision or point of view made and the last phase is reacting or showing the behaviour which is the consequence of the perception process.

There are various factors which affect the process of the perception. These factors may be the own traits of the individual (perceivers), traits of the object, individual, situation being perceived and the

environmental condition where the individual (perceiver) is accumulating the stimuli or the information to develop a perception.

CASE STUDY 3.1 HY DAIRIES, INC.

Syd Gilman read the latest sales figures with a great deal of satisfaction. The vice president of marketing at Hy Dairies, Inc., a large Midwestern milk products manufacturer, was pleased to see that the marketing campaign to improve sagging sales of Hy's gourmet ice cream brand was working. Sales volume and market share of the product had increased significantly over the past two quarters compared with the previous year.

The improved sales of Hy's gourmet ice cream could be credited to Rochelle Beauport, who was assigned to the gourmet ice cream brand last year. Beauport had joined Hy less than two years ago as an assistant brand manager after leaving a similar job at a food products firm. She was one of the few women of color in marketing management at Hy Dairies and had a promising career with the company. Gilman was pleased with Beauport's work and tried to let her know this in annual performance reviews. He now had an excellent opportunity to reward her by offering her the recently vacated position of market research coordinator. Although technically only a lateral transfer with a modest salary increase, the marketing research coordinator job would give Beauport broader experience in some high-profile work, which would enhance her career with Hy Dairies. Few people were aware that Gilman's own career had been boosted by working as marketing research coordinator at Hy several years before.

Rochelle Beauport had also seen the latest sales figures on Hy's gourmet ice cream and was expecting Gilman's call to meet with her that morning. Gilman began the conversation by briefly mentioning the favorable sales figures, and then explained that he wanted Beauport to take the marketing research coordinator job. Beauport was shocked by the news. She enjoyed brand management and particularly the challenge involved with controlling a product that directly affected the company's profitability. Marketing research coordinator was a technical support position—a "backroom" job—far removed from the company's bottom-line activities. Marketing research was not the route to top management in most organizations, Beauport thought. She had been sidelined.

After a long silence, Beauport managed a weak, "Thank you, Mr. Gilman." She was too bewildered to protest. She wanted to collect her thoughts and reflect on what she had done wrong. Also, she did not know her boss well enough to be openly critical.

Gilman recognized Beauport's surprise, which he assumed was her positive response to hearing of this wonderful career opportunity. He, too, had been delighted several years earlier about his temporary transfer to marketing research to round out his marketing experience. "This move will be good for both you and Hy Dairies," said Gilman as he escorted Beauport from his office.

Beauport was preoccupied with several tasks that afternoon but was able to consider the day's events that evening. She was one of the top women and few minorities in brand management at Hy Dairies and feared that she was being sidelined because the company didn't want women or people of color in top management. Her previous employer had made it quite clear that women "couldn't take the heat" in marketing management and tended to place women in technical support positions after a brief term in lower brand management jobs. Obviously Syd Gilman and Hy Dairies were following the same game plan. Gilman's comments that the coordinator job would be good for her was just a nice way of saying that Beauport couldn't go any further in brand management at Hy Dairies.

Beauport now faced the difficult decision of whether to confront Gilman and try to change Hy Dairies' sexist and possibly racist practices or to leave the company.

Discussion Questions

1. Apply your knowledge of stereotyping and social identity theory to explain what went wrong here.
2. What other perceptual errors are apparent in this case study?
3. What can organizations do to minimize misperceptions in these types of situations?

For the students of

B. Com. (Hons), Sem: IV

Name of Paper: International business

Prepared by: Dr. Praveen Joshi

Regional Economic Integration

Regional Economic Integration can best be defined as an agreement between groups of countries in a geographic region, to reduce and ultimately remove tariff and non-tariff barriers to the free flow of goods, services, and factors of production between each other. The following are examples of Regional Economic Integration: Å NAFTA (North American Free Trade Agreement)-An agreement among the U.S.A., Canada, and Mexico. ÅEU (European Union)-A trade agreement with 15 European countries. ÅAPEC (Asian Pacific Economic Cooperation Forum) - This includes NAFT A members, Japan, and China.

Levels of Economic Integration

The following are the levels of integration from least to most integrated: Free Trade, Customs Union, Common Market, Economic Union, and Political Union. With free trade, all the barriers to the trade of goods and services among member countries are removed. However, each country can determine its own trade policies regarding nonmembers. Members are free to determine the level of protection applied to goods coming from the outside. Customs Union is one step closer to political and economic integration. This union also eliminates trade barriers between member countries and adopts a common external trade policy. In a Common Market, labor and capital are free to move and there are no restrictions on emigration, emigration and cross-border flows of capital between member-countries. With the Economic Union, common currency, common tax rate, fiscal, and monetary policy are all required. The European Union is currently working toward an Economic Integration with the implementation of the Euro. The Political Union coordinates the bureaucracy accountability to the member nations.

Different types of Economic Integration

Economic integration among the world economies varies in degrees. They are:

Preferential trade Area – It is a form of economic integration where a group of country makes formal agreement to trade goods and services on preferential terms. It results in reduced

tariffs and sometimes a special quota is allowed for preferential access. These agreements are generally made between developed and developing countries to promote economic development of developing nations.

Free Trade Area - If a group of countries agree to abolish all trade restrictions and barriers among or charge low rates of tariffs in carrying out international trade, such a group is called Free Trade Area. These countries impose trade barriers and restrictions with regard to trade with countries other than the members of the group independently.

Custom Union ï the member countries of the custom union have two basic features. They are

- The member countries abolish all the restrictions and barriers on trade among themselves or charge low rates of tariffs.
- They adopt a uniform commercial policy of barriers and restriction jointly with regard to the trade with the nonmember countries.

Thus, custom union is advanced in degree compared to free trade area.

Common Market ï It has three basic features. They are:

- The member countries abolish all the restrictions and barriers on trade among themselves or charge low rates of tariffs.
- They adopt a uniform commercial policy of barriers and restriction jointly with regard to the trade with the nonmember countries.
- They allow free movement of human resources and capital among the member countries.

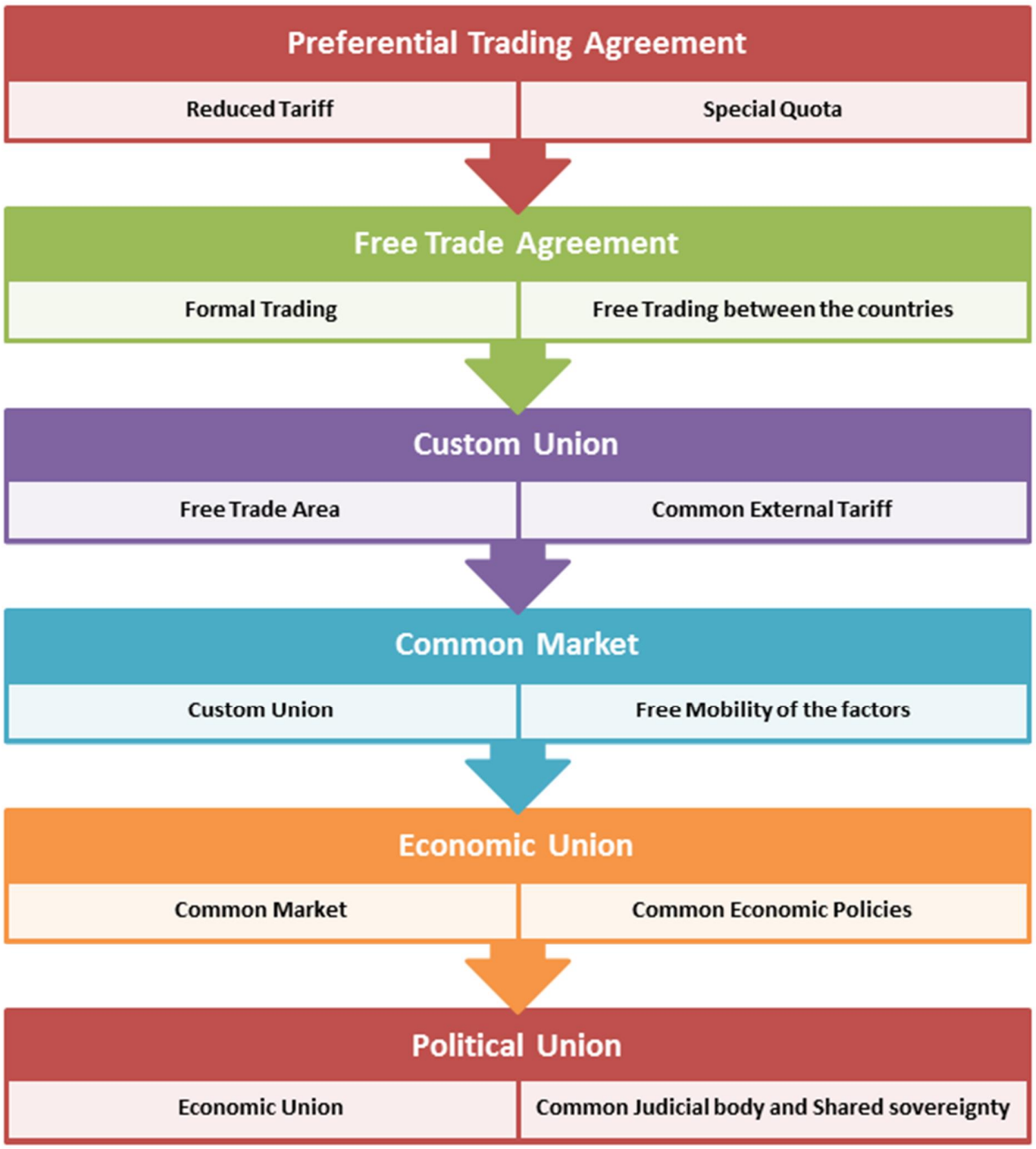
Thus, common market is superior to customs union.

Economic Union – It has four basic features. They are:

- The member countries abolish all the restrictions and barriers on trade among themselves or charge low rates of tariffs.
- They adopt a uniform commercial policy of barriers and restriction jointly with regard to the trade with the nonmember countries.
- They allow free movement of human resources and capital among the member countries
- They achieve uniformity in monetary policy and fiscal policy among the member countries.

Thus, economic union is superior to common market.

Political Union ï Political Union involves all features of economic union and also complete political integration between member countries. The member countries share a common decision making and judicial body and there is complete unity between member nations.



The advantages and disadvantages of creating regional agreements are as follows:

Advantages

- **Trade creation.** These agreements create more opportunities for countries to trade with one another by removing the barriers to trade and investment. Due to a reduction or removal of tariffs, cooperation results in cheaper prices for consumers in the bloc

countries. Studies indicate that regional economic integration significantly contributes to the relatively high growth rates in the less-developed countries.

- **Employment opportunities.** By removing restrictions on labor movement, economic integration can help expand job opportunities.
- **Consensus and cooperation.** Member nations may find it easier to agree with smaller numbers of countries. Regional understanding and similarities may also facilitate closer political cooperation.

Disadvantages

The disadvantages involved in creating regional agreements include the following:

- **Trade diversion.** The flip side to trade creation is trade diversion. Member countries may trade more with each other than with nonmember nations. This may mean increased trade with a less efficient or more expensive producer because it is in a member country. In this sense, weaker companies can be protected inadvertently with the bloc agreement acting as a trade barrier. In essence, regional agreements have formed new trade barriers with countries outside of the trading bloc.
- **Employment shifts and reductions.** Countries may move production to cheaper labor markets in member countries. Similarly, workers may move to gain access to better jobs and wages. Sudden shifts in employment can tax the resources of member countries.
- **Loss of national sovereignty.** With each new round of discussions and agreements within a regional block, nations may find that they have to give up more of their political and economic rights. In the opening case study, you learned how the economic crisis in Greece is threatening not only the EU in general but also the rights of Greece and other member nations to determine their own domestic economic policies.

For the students of

B. Com. (Hons), Sem: IV

Name of Paper: Operations Research

Prepared by: Dr. Ankita Sajjan

Optimality test: Modified distribution (MODI) method.

MODIFIED DISTRIBUTION (MODI) METHOD

This method is an improvement over stepping stone method. In the stepping stone method we evaluate water cell and finally select the water cell for tracing a closed path which allows reduction in the total cost.

Instead of evaluating each and every watercell, in the MODI method, we make use of the for testing optimality. This method is more convenient in identifying the water cell and there is no need to trace the closed paths for all the water cells. We draw the closed for one water cell which is identified as the one which offers scope for further reduction cost or improvement in the total pay off.

The identification of the most favourable cell is made with the help of values determined for the set of dual variables.

This method is an efficient procedure for solving large transportation problems which is based on the dual to the transportation problem.

When the dual is used, its solution yields two types of variables:

u_i = Implicit cost (or shadow price) of source i (value of one more unit at source i)

v_i Implicit cost of destination j (value of one more unit at j)

<u>Steps To Solve Transportation Problem Using Stepping Stone Method:</u>

The step involved in MODI method are as follows:

STEP 1:

Calculate the cell evaluators and test for optimality. If k_{ij} denote the cell evaluator, then

$$\mathbf{k_{ij} = c_{ij} (u_i + v_j).}$$

The cell evaluator or (cell value) is the difference between the actual cost (c_{ij}) of shipping one unit from i to j and the sum of the implicit cost of source 'i' and destination ǵô

The value of u_i and v_j for the occupied cells are calculated using the equation

$$\mathbf{u_i + v_j = c_{ij}}$$

Where i = l, 2, 3 .... m and j = 1,2....n.

To start with, u_i or v_j can be assumed as zero arbitrarily and the value of other variables are calculated for all occupied (stone) cells.

STEP 2 :

For the unoccupied (or water) cells the cell value is calculated as.

$k_{ij} = c_{ij} (u_i + v_j)$.

k is also called as **cell evaluator** or **cell evaluation index.**

STEP 3 :

Test of optimality: The optimality test is identical to that or stepping-stone method the optimal solution require that all cell evaluators be non-negative (in minimisation)

STEP 4 :

Identify the incoming cell and design for improved solution:

The incoming cell for a minimisation problem is located by identifying the most negative cell evaluated (The largest positive evaluator in case of maximisation). The improved solution is obtained by shifting as many units as possible around a closed path into the identified water cell without violating demand and supply requirements.

STEP 5 :

Repeat the steps 1 to 4 until optimality is achieved.

(All cell evaluators for the empty cells are computed by first recalculating the u's and v 's using the equation c_{ij} (u_i + v_j) for the occupied cells- If all cell evaluators are positive, the solution is optimal).

Practical Problem (solved)

Find Solution using Voggel's Approximation method, also find optimal solution using modi method,

	D1	**D2**	**D3**	**D4**	**Supply**
S1	11	13	17	14	250

S2	16	18	14	10	300
S3	21	24	13	10	400
Demand	200	225	275	250	

Solution:

TOTAL number of supply constraints : 3
TOTAL number of demand constraints : 4

Problem Table is

	D1	D2	D3	D4	**Supply**
S1	11	13	17	14	**250**
S2	16	18	14	10	**300**
S3	21	24	13	10	**400**
Demand	**200**	**225**	**275**	**250**	

Table-1

	D1	D2	D3	D4	**Supply**	**Row Penalty**
S1	11	13	17	14	**250**	**2=13-11**
S2	16	18	14	10	**300**	**4=14-10**
S3	21	24	13	10	**400**	**3=13-10**
Demand	200	225	275	250		

Column Penalty	**5=16-11**	**5=18-13**	**1=14-13**	**0=10-10**		

The maximum penalty, 5, occurs in column D1.

The minimum cij in this column is c11 = 11.

The maximum allocation in this cell is min(250,200) = 200.
It satisfy demand of D1 and adjust the supply of S1 from 250 to 50 (250 - 200 = 50).

Table-2

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13	17	14	50	1=14-13
S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	225	275	250		
Column Penalty	--	5=18-13	1=14-13	0=10-10		

The maximum penalty, 5, occurs in column D2.

The minimum cij in this column is c12 = 13.

The maximum allocation in this cell is min(50,225) = 50.
It satisfy supply of S1 and adjust the demand of D2 from 225 to 175 (225 - 50 = 175).

Table-3

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--

S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	175	275	250		
Column Penalty	--	6=24-18	1=14-13	0=10-10		

The maximum penalty, 6, occurs in column D2.

The minimum cij in this column is c22 = 18.

The maximum allocation in this cell is min(300,175) = 175.
It satisfy demand of D2 and adjust the supply of S2 from 300 to 125 (300 - 175 = 125).

Table-4

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18(175)	14	10	125	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	0	275	250		
Column Penalty	--	--	1=14-13	0=10-10		

The maximum penalty, 4, occurs in row S2.

TOTAL number of supply constraints : 3
TOTAL number of demand constraints : 4
Problem Table is

	D1	D2	D3	D4	Supply
S1	11	13	17	14	250
S2	16	18	14	10	300
S3	21	24	13	10	400
Demand	200	225	275	250	

Table-1

	D1	D2	D3	D4	Supply	Row Penalty
S1	11	13	17	14	250	2=13-11
S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	200	225	275	250		
Column Penalty	5=16-11	5=18-13	1=14-13	0=10-10		

The maximum penalty, 5, occurs in column D1.

The minimum cij in this column is c11 = 11.

The maximum allocation in this cell is min(250,200) = 200.
It satisfy demand of D1 and adjust the supply of S1 from 250 to 50 (250 - 200 = 50).

Table-2

	D1	D2	D3	D4	Supply	Row Penalty

S1	11(200)	13	17	14	50	1=14-13
S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	225	275	250		
Column Penalty	--	5=18-13	1=14-13	0=10-10		

The maximum penalty, 5, occurs in column D2.

The minimum cij in this column is c12 = 13.

The maximum allocation in this cell is min(50,225) = 50.
It satisfy supply of S1 and adjust the demand of D2 from 225 to 175 (225 - 50 = 175).

Table-3

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	175	275	250		
Column Penalty	--	6=24-18	1=14-13	0=10-10		

The maximum penalty, 6, occurs in column D2.

The minimum cij in this column is c22 = 18.

The maximum allocation in this cell is min(300,175) = 175.
It satisfy demand of D2 and adjust the supply of S2 from 300 to 125 (300 - 175 = 125).

Table-4

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18(175)	14	10	125	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	0	275	250		
Column Penalty	--	--	1=14-13	0=10-10		

The maximum penalty, 4, occurs in row S2.

The minimum cij in this row is c24 = 10.

The maximum allocation in this cell is min(125,250) = 125.
It satisfy supply of S2 and adjust the demand of D4 from 250 to 125 (250 - 125 = 125).

Table-5

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18(175)	14	10(125)	0	--
S3	21	24	13	10	400	3=13-10
Demand	0	0	275	125		
Column	--	--	13	10		

Penalty						

The maximum penalty, 13, occurs in column D3.

The minimum cij in this column is c33 = 13.

The maximum allocation in this cell is min(400,275) = 275.
It satisfy demand of D3 and adjust the supply of S3 from 400 to 125 (400 - 275 = 125).

Table-6

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18(175)	14	10(125)	0	--
S3	21	24	13(275)	10	125	10
Demand	0	0	0	125		
Column Penalty	--	--	--	10		

The maximum penalty, 10, occurs in row S3.

The minimum cij in this row is c34 = 10.

The maximum allocation in this cell is min(125,125) = 125.
It satisfy supply of S3 and demand of D4.

Initial feasible solution is

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	250	2 | 1 | -- | -- | -- | -- |

S2	16	18(175)	14	10(125)	300	4 | 4 | 4 | 4 | -- | -- |
S3	21	24	13(275)	10(125)	400	3 | 3 | 3 | 3 | 3 | 10 |
Demand	200	225	275	250		
Column Penalty	5 -- -- -- -- --	5 5 6 -- -- --	1 1 1 1 13 --	0 0 0 0 10 10		

The minimum total transportation
cost =11×200+13×50+18×175+10×125+13×275+10×125=12075

Here, the number of allocated cells = 6 is equal to m + n - 1 = 3 + 4 - 1 = 6
∴ This solution is non-degenerate

OPTIMALITY TEST USING MODI METHOD...

Allocation Table is

	D1	D2	D3	D4		Supply
S1	11 (200)	13 (50)	17	14		250
S2	16	18 (175)	14	10 (125)		300
S3	21	24	13 (275)	10 (125)		400
Demand	200	225	275	250		

TOTAL number of supply constraints : 3
TOTAL number of demand constraints : 4
Problem Table is

	D1	D2	D3	D4	Supply

S1	11	13	17	14	250
S2	16	18	14	10	300
S3	21	24	13	10	400
Demand	200	225	275	250	

Table-1

	D1	D2	D3	D4	Supply	Row Penalty
S1	11	13	17	14	250	2=13-11
S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	200	225	275	250		
Column Penalty	5=16-11	5=18-13	1=14-13	0=10-10		

The maximum penalty, 5, occurs in column D1.

The minimum cij in this column is c11 = 11.

The maximum allocation in this cell is min(250,200) = 200.
It satisfy demand of D1 and adjust the supply of S1 from 250 to 50 (250 - 200 = 50).

Table-2

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13	17	14	50	1=14-13

S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	225	275	250		
Column Penalty	--	5=18-13	1=14-13	0=10-10		

The maximum penalty, 5, occurs in column D2.

The minimum cij in this column is c12 = 13.

The maximum allocation in this cell is min(50,225) = 50.
It satisfy supply of S1 and adjust the demand of D2 from 225 to 175 (225 - 50 = 175).

Table-3

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18	14	10	300	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	175	275	250		
Column Penalty	--	6=24-18	1=14-13	0=10-10		

The maximum penalty, 6, occurs in column D2.

The minimum cij in this column is c22 = 18.

The maximum allocation in this cell is min(300,175) = 175.
It satisfy demand of D2 and adjust the supply of S2 from 300 to 125 (300 - 175 = 125).

Table-4

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18(175)	14	10	125	4=14-10
S3	21	24	13	10	400	3=13-10
Demand	0	0	275	250		
Column Penalty	--	--	1=14-13	0=10-10		

The maximum penalty, 4, occurs in row S2.

The minimum cij in this row is c24 = 10.

The maximum allocation in this cell is min(125,250) = 125.
It satisfy supply of S2 and adjust the demand of D4 from 250 to 125 (250 - 125 = 125).

Table-5

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18(175)	14	10(125)	0	--
S3	21	24	13	10	400	3=13-10
Demand	0	0	275	125		
Column Penalty	--	--	13	10		

The maximum penalty, 13, occurs in column D3.

The minimum cij in this column is c33 = 13.

The maximum allocation in this cell is min(400,275) = 275.
It satisfy demand of D3 and adjust the supply of S3 from 400 to 125 (400 - 275 = 125).

Table-6

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	0	--
S2	16	18(175)	14	10(125)	0	--
S3	21	24	13(275)	10	125	10
Demand	0	0	0	125		
Column Penalty	--	--	--	10		

The maximum penalty, 10, occurs in row S3.

The minimum cij in this row is c34 = 10.

The maximum allocation in this cell is min(125,125) = 125.
It satisfy supply of S3 and demand of D4.

Initial feasible solution is

	D1	D2	D3	D4	Supply	Row Penalty
S1	11(200)	13(50)	17	14	250	2 | 1 | -- | -- | -- | -- |
S2	16	18(175)	14	10(125)	300	4 | 4 | 4 | 4 | -- | -- |
S3	21	24	13(275)	10(125)	400	3 | 3 | 3 | 3 | 3 | 10 |

Demand	200	225	275	250		
Column Penalty	5 -- -- -- -- --	5 5 6 -- -- --	1 1 1 1 13 --	0 0 0 0 10 10		

The minimum total transportation cost =11×200+13×50+18×175+10×125+13×275+10×125=12075

Here, the number of allocated cells = 6 is equal to m + n - 1 = 3 + 4 - 1 = 6
∴ This solution is non-degenerate

Optimality test using modi method...
Allocation Table is

	D1	D2	D3	D4	Supply
S1	11 (200)	13 (50)	17	14	250
S2	16	18 (175)	14	10 (125)	300
S3	21	24	13 (275)	10 (125)	400
Demand	200	225	275	250	

Iteration-1 of optimality test
1. Find ui and vj for all occupied cells(i,j), where cij=ui+vj

1. Substituting, u1=0, we get

2.c11=u1+v1⇒v1=c11-u1⇒v1=11-0⇒v1=11

3.c12=u1+v2⇒v2=c12-u1⇒v2=13-0⇒v2=13

4.c22=u2+v2⇒u2=c22-v2⇒u2=18-13⇒u2=5

5.c24=u2+v4⇒v4=c24-u2⇒v4=10-5⇒v4=5

6.c34=u3+v4⇒u3=c34-v4⇒u3=10-5⇒u3=5

7.c33=u3+v3⇒v3=c33-u3⇒v3=13-5⇒v3=8

	D1	D2	D3	D4	Supply	ui
S1	11 (200)	13 (50)	17	14	250	u1=0
S2	16	18 (175)	14	10 (125)	300	u2=5
S3	21	24	13 (275)	10 (125)	400	u3=5
Demand	200	225	275	250		
vj	v1=11	v2=13	v3=8	v4=5		

2. Find dij for all unoccupied cells(i,j), where dij=cij-(ui+vj)

1.d13=c13-(u1+v3)=17-(0+8)=9

2.d14=c14-(u1+v4)=14-(0+5)=9

3.d21=c21-(u2+v1)=16-(5+11)=0

4.d23=c23-(u2+v3)=14-(5+8)=1

5.d31=c31-(u3+v1)=21-(5+11)=5

6.d32=c32-(u3+v2)=24-(5+13)=6

	D1	D2	D3	D4	Supply	ui
S1	11 (200)	13 (50)	17 [9]	14 [9]	250	u1=0
S2	16 [0]	18 (175)	14 [1]	10 (125)	300	u2=5
S3	21 [5]	24 [6]	13 (275)	10 (125)	400	u3=5
Demand	200	225	275	250		
vj	v1=11	v2=13	v3=8	v4=5		

Since all dijÓ0.
So final optimal solution is arrived.

	D1	D2	D3	D4	Supply
S1	11 (200)	13 (50)	17	14	250
S2	16	18 (175)	14	10 (125)	300
S3	21	24	13 (275)	10 (125)	400
Demand	200	225	275	250	

The minimum total transportation
cost =11×200+13×50+18×175+10×125+13×275+10×125=12075
Notice alternate solution is available with unoccupied cell S2 D1:d21 = [0], but with the same optimal value.

Optimality test: Stepping Stone Method

TESTING FOR DEGENERACY

For a feasible transportation optimal solution there should be (m + n -1) occupied cells or allocations. Whenever the number of occupied cells is less than (m + n - 1) the solution is called 'degenerate solution' and it cannot be tested for optimality. HenceĂ the initial feasible solution obtained by any of the three methods viz.

(i) North-West Corner Rule,

(ii) Least cost method or

(iii) Vogel's approximation method should be checked for degeneracy.

Degeneracy may be encountered in an initial basic feasible solution, at an intermediate matrix or at optimality. To correct degeneracy in the initial feasible solution, introduce a zero or an infinitely small quantity ǿ' to the least cost vacant (unoccupied) cell to make the number of occupied cell equal to (m + n ð l).

Introduce as many number of 'e' as required to make the number of occupied cells to become equal to (m + n ð l).

When degeneracy occurs in the intermediate solution, introduce 'e' to one or more of the newly vacated cells so that the number of occupied cells become equal to (m + n ï 1).

TESTING FOR OPTIMALITY

Having obtained the initial feasible solution and testing for degeneracy, the optimal solution can be obtained by any of the following two methods:

(i) Stepping stone method, and

(ii) Modified Distribution (MODI) Method,

STEPPING STONE METHOD

This method is used to obtain an improved Solution which is an optimum solution (i.e., minimum total transportation cost in a minimisation problem or maximum total profit in a maximisation problem).

By using this method, we calculate the opportunity cost of each empty cell (also referred to as water cell or unoccupied cell). We determine the effect on the total cost if one unit is assigned to an empty cell. If the cost is reduced, then there will be an improved solution which would become an optimal solution.

Steps To Solve Transportation Problem Using Stepping Stone Method:

The steps involved in testing for optimality by evaluating the empty or water cells are:

1. Select an unused or water cell to be evaluated.
2. Beginning at this cell, trace a closed path back to the original cell (starting point) via occupied cells (called stone cells) and moving with only horizontal or vertical moves, starting in the clock-wise direction from the water cells being evaluated. (Refer rule for drawing each closed loop given at the end of this method).

3. Beginning with a (+) sign at the water cell, place (+) sign on each corner stone cell of the closed path that is traced.
4. For each water cell that is being evaluated, compute the changes in cost over the closed path (called cell evaluators). This is done by subtracting the total cost of the losing cells (with minus sign) from that of the gaining cells (With plus sign) in the closed loop).
5. If all cell evaluators (i.e., net changes in cost) are non-negative (i.e., zero or positive) in a minimisation problem, then the solution is optimal. Otherwise (i.e., if any cell evaluator for a water cell is negative) an improvement is possible. If a cell evaluator is zero, an alternative solution exists.
6. Generating an improved solution involves identifying the incoming cell and transferring as much as possible to it. The number of units to be transferred is the smallest number in a cell (with a minus sign) in the closed path. Once this has been done, a new solution is generated by adjusting the quantities in all losing and gaining cells along the loop (i.e., closed path).
7. The improved solution is then tested for optimality by repeating the step I to 6; another improvement made until an optimal solution is reached (that means, if no negative cell values are found, the current solution is the optimal solution.)

Points to be remembered are:

(i) The occupied cells have the allocated units circled and are called stone cells. The unoccupied cells or empty cells are called water cells.

(ii) The cells used for re-allocation are assigned plus and minus signs starting with plus sign at the water cell that is being evaluated and alternate minus and plus signs at the stone cells in the closed path (or loop).

(iii) Closed loop or path starts with the water cell whose additional allocation is being tested, but has to have minimum of three stone cells to work -out the optimality. Horizontal and vertical moves are made in clockwise direction stepping on the stone cells only. Allocation to a water cell and adjustments in stone cells are made such that the row and column requirements are not violated.

- **RULE FOR DRAWING EACH CLOSED LOOP**

When tracing a closed loop, start with the empty cell to be evaluated nod going draw an arrow from it to an occupied cell in the same row (or column). Next move vertically horizontally (but never diagonally) to another occupied cell, 'stepping over' unoccupied cells (if necessary) without changing them.

Follow the same procedure to the other occupied cells until returning to the original cell. At each turn of the loop (the loop may cross over itself some times) plus and minus signs are alternately placed in the cells, starting with a

(+) sign in the empty cell. One restriction is that there must be exactly one cell with a (+) sign and exactly one cell with a sign in any row or' column in which the loop turns.

Note that an **even number** four cells must participate in a loop and the occupied cells can be visited only once.

Finally, remember that all cells that receive a (+) or a (ð) except the first one must be occupied (that means, if no negative cell values are found, the current solution is the optimal solution).

Practical Problem (solved)

Find Solution using Vogel's Approximation Method(VAM), also find optimal solution using stepping stone method

	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

Solution:

TOTAL number of supply constraints : 3

TOTAL number of demand constraints : 4

Problem Table is

	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

Table-1

	D1	D2	D3	D4	Supply	Row Penalty
S1	19	30	50	10	7	9=19-10
S2	70	30	40	60	9	10=40-30
S3	40	8	70	20	18	12=20-8

Demand	5	8	7	14		
Column Penalty	21=40-19	22=30-8	10=50-40	10=20-10		

The maximum penalty, 22, occurs in column D2.

The minimum cij in this column is c32 = 8.

The maximum allocation in this cell is min(18,8) = 8.

It satisfy demand of D2 and adjust the supply of S3 from 18 to 10 (18 - 8 = 10).

Table-2

	D1	D2	D3	D4	Supply	Row Penalty
S1	19	30	50	10	7	9=19-10
S2	70	30	40	60	9	20=60-40
S3	40	8(8)	70	20	10	20=40-20
Demand	5	0	7	14		
Column	21=40-19	--	10=50-40	10=20-10		

Penalty						

The maximum penalty, 21, occurs in column D1.

The minimum cij in this column is c11 = 19.

The maximum allocation in this cell is min(7,5) = 5.

It satisfy demand of D1 and adjust the supply of S1 from 7 to 2 (7 - 5 = 2).

Table-3

	D1	D2	D3	D4	Supply	Row Penalty
S1	19(5)	30	50	10	2	40=50-10
S2	70	30	40	60	9	20=60-40
S3	40	8(8)	70	20	10	50=70-20
Demand	0	0	7	14		
Column Penalty	--	--	10=50-40	10=20-10		

The maximum penalty, 50, occurs in row S3.

The minimum cij in this row is c34 = 20.

The maximum allocation in this cell is min(10,14) = 10.

It satisfy supply of S3 and adjust the demand of D4 from 14 to 4 (14 - 10 = 4).

Table-4

	D1	D2	D3	D4		Supply	Row Penalty
S1	19(5)	30	50	10		2	40=50-10
S2	70	30	40	60		9	20=60-40
S3	40	8(8)	70	20(10)		0	--
Demand	0	0	7	4			
Column Penalty	--	--	10=50-40	50=60-10			

The maximum penalty, 50, occurs in column D4.

The minimum cij in this column is c14 = 10.

The maximum allocation in this cell is min(2,4) = 2.

It satisfy supply of S1 and adjust the demand of D4 from 4 to 2 (4 - 2 = 2).

Table-5

	D1	D2	D3	D4	Supply	Row Penalty
S1	19(5)	30	50	10(2)	0	--
S2	70	30	40	60	9	20=60-40
S3	40	8(8)	70	20(10)	0	--
Demand	0	0	7	2		
Column Penalty	--	--	40	60		

The maximum penalty, 60, occurs in column D4.

The minimum cij in this column is c24 = 60.

The maximum allocation in this cell is min(9,2) = 2.

It satisfy demand of D4 and adjust the supply of S2 from 9 to 7 (9 - 2 = 7).

Table-6

	D1	D2	D3	D4	Supply	Row Penalty
S1	19(5)	30	50	10(2)	0	--

S2	70	30	40	60(2)	7	40
S3	40	8(8)	70	20(10)	0	--
Demand	0	0	7	0		
Column Penalty	--	--	40	--		

The maximum penalty, 40, occurs in row S2.

The minimum cij in this row is c23 = 40.

The maximum allocation in this cell is min(7,7) = 7.

It satisfy supply of S2 and demand of D3.

Initial feasible solution is

	D1	D2	D3	D4	Supply	Row Penalty
S1	19(5)	30	50	10(2)	7	9 | 9 | 40 | 40 | -- | -- |
S2	70	30	40(7)	60(2)	9	10 | 20 | 20 | 20 | 20 | 40 |

S3	40	8(8)	70	20(10)	18	12 | 20 | 50 | -- | -- | -- |
Demand	5	8	7	14		
Column Penalty	21 21 -- -- -- --	22 -- -- -- -- --	10 10 10 10 40 40	10 10 10 50 60 --		

The minimum total transportation cost =19×5+10×2+40×7+60×2+8×8+20×10=779

Here, the number of allocated cells = 6 is equal to m + n - 1 = 3 + 4 - 1 = 6

∴ This solution is non-degenerate

OPTIMALITY TEST USING STEPPING STONE METHOD...

Allocation Table is

	D1	D2	D3	D4	Supply
S1	19 (5)	30	50	10 (2)	7

S2	70	30	40 (7)	60 (2)	9
S3	40	8 (8)	70	20 (10)	18
Demand	5	8	7	14	

Iteration-1 of optimality test

1. Create closed loop for unoccupied cells, we get

Unoccupied cell	Closed path	Net cost change
S1D2	S1D2Ÿ S1D4Ÿ S3D4Ÿ S3D2	30 - 10 + 20 - 8 = 32
S1D3	S1D3Ÿ S1D4Ÿ S2D4Ÿ S2D3	50 - 10 + 60 - 40 = 60
S2D1	S2D1Ÿ S2D4Ÿ S1D4Ÿ S1D1	70 - 60 + 10 - 19 = 1
S2D2	S2D2Ÿ S2D4Ÿ S3D4Ÿ S3D2	30 - 60 + 20 - 8 = -18
S3D1	S3D1Ÿ S3D4Ÿ S1D4Ÿ S1D1	40 - 20 + 10 - 19 = 11
S3D3	S3D3Ÿ S3D4Ÿ S2D4Ÿ S2D3	70 - 20 + 60 - 40 = 70

2. Select the unoccupied cell having the highest negative net cost change i.e. cell S2D2=-18, and draw a closed path from S2D2.

Closed path is S2D2Ÿ S2D4Ÿ S3D4Ÿ S3D2

Closed path and plus/minus allocation for current unoccupied cell S2D2

	D1	D2	D3	D4	Supply
S1	19 (5)	30 [32]	50 [60]	10 (2)	7
S2	70 [1]	30 [-18] (+)	40 (7)	60 (2) (-)	9
S3	40 [11]	8 (8) (-)	70 [70]	20 (10) (+)	18
Demand	5	8	7	14	

3. Minimum allocated value among all negative position (-) on closed path = 2

Substract 2 from all (-) and Add it to all (+)

	D1	D2	D3	D4	Supply
S1	19 (5)	30	50	10 (2)	7
S2	70	30 (2)	40 (7)	60	9

S3	40	8 (6)	70	20 (12)	18
Demand	5	8	7	14	

4. Repeat the step 1 to 3, until an optimal solution is obtained.

Iteration-2 of optimality test

1. Create closed loop for unoccupied cells, we get

Unoccupied cell	Closed path	Net cost change
S1D2	S1D2Ÿ S1D4Ÿ S3D4Ÿ S3D2	30 - 10 + 20 - 8 = 32
S1D3	S1D3Ÿ S1D4Ÿ S3D4Ÿ S3D2Ÿ S2D2Ÿ S2D3	50 - 10 + 20 - 8 + 30 - 40 = 42
S2D1	S2D1Ÿ S2D2Ÿ S3D2Ÿ S3D4Ÿ S1D4Ÿ S1D1	70 - 30 + 8 - 20 + 10 - 19 = 19
S2D4	S2D4Ÿ S2D2Ÿ S3D2Ÿ S3D4	60 - 30 + 8 - 20 = 18
S3D1	S3D1Ÿ S3D4Ÿ S1D4Ÿ S1D1	40 - 20 + 10 - 19 = 11
S3D3	S3D3Ÿ S3D2Ÿ S2D2Ÿ S2D3	70 - 8 + 30 - 40 = 52

Since all net cost change Ó0

So final optimal solution is arrived.

	D1	D2	D3	D4	Supply
S1	19 (5)	30	50	10 (2)	7
S2	70	30 (2)	40 (7)	60	9
S3	40	8 (6)	70	20 (12)	18
Demand	5	8	7	14	

The minimum total transportation cost =19×5+10×2+30×2+40×7+8×6+20×12=743

FOR THE STUDENTS OF

B.COM(HONS.) SEM IV

NAME OF PAPER –OPERATIONS RESEARCH

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Linear Programming

Linear programming (LP) can be defined as matrix algebra's application that is formulated to have a solution of problems of wider class and linear equations are used to represent them. A linear equation i.e. equation which is algebraic, the variable/variables quantities of which are first powered only and the graph of which is made will give a straight line. These problems are attributed objective function which is to be minimized/maximized depending upon the need of the problem, and this subject to a number of constraints. Both constraint and objective function are represented with respect to linear equality or inequality. In a typical situation; the objective function would be given for profit maximisation (e.g., margins) or cost minimization (like variable costs). The following assumptions need to be satisfied to justify the use of linear programming:

- Linearity. functions, such as prices, costs and technical needs, must follow linearity function.
- Certainty. parameters are expected to be known with certainty.

- Non-negativity. decision variables if turn out to be negative will not be acceptable.

Two approaches are commonly used to solve LP problems:

- Graphical method
- Simplex method

In this module we shall focus on Graphical Method. The graphical method is limited to LP problems involving two decision variables and a limited number of constraints due to the difficulty of graphing and evaluating more than two decision variables. This restriction severely limits the use of the graphical method for real-world problems. The graphical method is presented first here, however, because it is simple and easy to understand and it is a very good learning tool.

The steps involved in solving a LP problem graphically are explained below:

Step-1: Formation of the LP problem

Formulation refers to translating the real-world problem into a format of mathematical equations that represent the objective function and the constraint set. A proper perception of the question is needed for formulating it in a correct manner.

Step-2: Plotting the lines of constraint on the graph

Constraint lines represents the scarcity of resources which are available. Generally, constraint lines are drawn by interconnecting the vertical & horizontal intercepts that are solved from each equation constraint.

Step-3: Determining the valid side of the constraint line

The easy way out would be to initiate with the plugging in of the origin coordinates (0, 0) and analyse whether the constraint is satisfied. If it is the case, then all points on the origin side of the line are feasible (valid), and all points on the other side of the line are infeasible (invalid). If the constraint is not satisfied by (0, 0), then all points on the other side and away from origin are feasible (valid), and all points on the origin side of the constraint line are infeasible (invalid)

Step-4: Identifying region of feasible solution

The feasible solution represents the area on the graph that is valid for all constraints. Choosing any point in this area will result in a valid solution.

Step-5: Plotting the objective function to determine the direction of improvement

Betterment is along the direction of value which is greater when goal is maximization of objective function, and on the other hand when the objective is minimization of objective function then betterment would be in the direction of value which is lesser. For determination of direction that is desirable to move along , objective function may or may not include feasible region.

Step-6: Find the appropriate corner

Solutions which are optimal occur at corners. The corner which is most relevant, feasible solution region's last point, touched by a line that is parallel to the two objective function lines. When more than one corner conform to solution which is optimal, each corner and all points along the line interlinking the corners conform to optimal solutions.

Let us consider an example: **Production of wooden tables and chairs**

In this example we will look at the profit maximization problem that a furniture manufacturer faces. The manufacturer uses wood and labor (inputs) to produce tables and chairs (output). We consider that the manufacturer earns Rs. 60 and Rs. 80 for each unit of table and chair respectively. Also the availability of wood is 3000 units and that of labor is 1100 units. And it takes 300 units of wood and 50 units of labour to make a table and 200 units of wood and 100 units of labour to make a chair. The following table depicts the relevant information for this LP problem.

Table 1:

Input	**Table (X_1)**	**Chair (X_2)**	**Availability**
Wood	300	200	3000
Labor	50	100	1100
Unit Profit	**Rs. 60**	**Rs. 80**	

Formation of the LP problem

With help of the table we will formulate the objective function. An objective function is developed in such a way that it is either maximized or minimized. In our example the objective would be to maximise unit profit. Wood and labor row in the table is used to formulate the constraint line. We state the non-negativity conditions.

Maximize: $Z = 60X_1 + 80X_2$ (objective function, Z = profit)

Subject to: $300X_1 + 200X_2 \leq 3000$ (wood constraint)

$50X_1 + 100X_2 \leq 1100$ (labor constraint)

$X_1, X_2 \geq 0$ (non-negativity conditions)