ADVANCED COST & FINANCIAL MANAGEMENT

EXECUTIVE DIPLOMA IN COST & MANAGEMENT ACCOUNTING FOR ENGINEERS

MODULE V

DIRECTORATE OF ADVANCED STUDIES
THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

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Behind every successful business decision, there is always a CMA

MISSION STATEMENT

The CMA Professionals would ethically drive enterprises globally by creating value to stakeholders in the socio-economic context through competencies drawn from the integration of strategy, management and accounting.

VISION STATEMENT

The Institute of Cost Accountants of India would be the preferred source of resources and professionals for the financial leadership of enterprises globally.

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DIRECTORATE OF ADVANCED STUDIES
THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

ABOUT THE COURSES

01: EXECUTIVE DIPLOMA IN BUSINESS VALUATION

Valuation, particularly financial valuation, is emerging as an important profession, with the growth in the profession of financial analysts due to various factors like increased interest in mergers, acquisitions, demerger and divestiture, increased interest of PE firms in Indian business and implementation of IndAS. The valuation profession is expected to get a boost with the introduction of the concept of Registered Valuers in the Companies Act 2013. Registered Valuers will provide valuation in respect of property, stocks, shares, debentures, securities, goodwill or any other assets or net worth of a company or its assets or liabilities.

This diploma course aims to develop proficiency in Valuing assets and liabilities through a learning process that blends concepts with applications. The course is an advanced knowledge module that presupposes understanding of management accounting and corporate finance. The participants will get extensive exposure through project work on Valuation and by analyzing case studies.

Course Duration: 6 months

02: EXECUTIVE DIPLOMA IN COST & MANAGEMENT ACCOUNTING FOR ENGINEERS

In modern competitive business environment, suitable business decision making is very crucial. All professionals irrespective of their domain expertise need to understand the commercial aspects of the business, contribute effectively and efficiently to the strategic business decisions making.

Engineers being the frontline technocrats, are part of the team for taking various commercial decisions in the interest of the organization, which requires adequate expertise to understand the various facets of the Cost, Finance, Taxation, Laws and other such aspects. This course has been specifically designed for Engineers to synergies their domain expertise with the commercial link in a most practical oriented manner.

Course Duration: 6 months

03: CERTIFICATE COURSE IN ARBITRATION

Arbitration is a form of alternative dispute resolution (ADR), is a technique for the resolution of disputes outside the courts, the parties to a dispute refer it to Arbitration by one or more persons (the arbitrators awards or arbitral Tribunal), and agree to BE bound by the arbitration decision (the award). A third party reviews the evidences in the case and imposes a decision that is legally binding on both sides and enforceable in the courts. In fact Arbitration is a process in which disputants can resolve dispute amicably. This method can bring solutions to disputes as well as among disputants.

The objective of this course is to familiarize the participants with legal framework of arbitration, arbitration procedures, and arbitration practice. It is also designed to cover practical aspects covering case analysis and mock arbitral proceedings.

Course Duration: 3 months

04: CERTIFICATE COURSE IN GOODS AND SERVICES TAX (GST)

Goods & Services Tax (GST) is a major tax reform in the Country and is a game changer. There has been a paradigm shift in the Indirect Tax structure with the GST rollout w.e.f 01st July 2017. As a professional, it is imperative to understand and assimilate the new taxation structure, associated compliances and the changes in business processes emanating there from.

In the above backdrop, a course module on GST has been planned so as to upgrade the knowledge level of our members & professionals in a structured and practical oriented manner. Institute has twin expectations from this course, first the GST concepts and implementation has to be understood in a simple way by our professional colleagues, and second the same can be percolated to the business houses, traders and other such concerns having GST impact in their respective locations. This course is being launched in association with Tax Research Department of the Institute.

Course Duration: 3 months

Email: advstudies@icmai.in

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Tools & Techniques for Decision Making

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Relevant Experience

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STRATEGIC DECISION MAKER

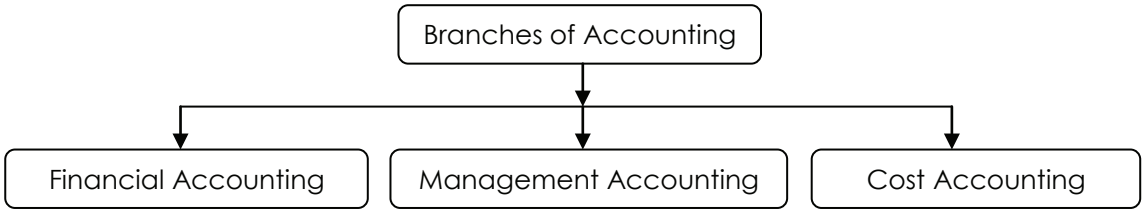
CMD / MD / CEO / COO / PRESIDENT / VICE-PRESIDENT

CAREER PATH FOR ENGINEERS TO BECOME STRATEGIC DECISION MAKERS

1 INTRODUCTION

INTRODUCTION

Accounting involves collection, recording, classification and presentation of financial data. The word 'Accounting' can be classified into three categories: (A) Financial Accounting (B) Management Accounting and (C) Cost Accounting.



FINANCIAL ACCOUNTING:

Financial Accounting has come into existence with the development of large-scale business in the form of joint-stock companies. As public money is involved in share capital, Companies Act has provided a legal framework to present the operating results and financial position of the company. Financial Accounting is concerned with the preparation of Profit and Loss Account and Balance Sheet to disclose information to the shareholders. Financial accounting is oriented towards the preparation of financial statements, which summarises the results of operations for select periods of time and show the financial position of the business on a particular date. Financial Accounting is concerned with providing information to the external users. Preparation of financial statements is a statutory obligation. Financial Accounting is required to be prepared in accordance with Generally Accepted Accounting Principles and Practices.

Cost Accounting

It is the process of accounting for cost which begins with recording of expenditure and ends tihe the preparation of statistical date. It formal mechanism by means of which cost of products or services are ascertained and controlled. Cost accounting is helpful to the management in decision making. Decision making requires, apart from other information, cost information which is provided by cost accounting. cost can be ascertained either by following the historical or predetermined system of costing. Cost can be predetemined either by standard costing or estimated costing.

Management Accounting

Management Accounting a new approach to accounting. The function of Management Acconting is to reduce the uncertainty and help the management in the decision making process. Management accounting is that field of accounting, which deals with providing information including financial accounting information to managers for their use in planning, deccision-making, performance evaluation, control, management of cost and cost determination for financial reporting. Managerial accounting contains reports prepared to fulfill the needs of managements.

Definition

The Certified Institute of Management Accountants (CIMA) of UK defines the term 'Management Accounting' in the following manager:" Management Accounting is can integral part of management concerned with identifying presenting and interpreting information for:

1. Formulating strategy
2. Planning and controling activites
3. Decision taking
4. Optimizing the use of resources
5. Safeguarding assets

SIGNIFICANCE OF MANAGEMENT ACCOUNTING

The various advantages that accrue out of management accounting are enumerated below:

(1) **Delegation of Authority:** Now a day the function of management is no longer personal, management accounting helps the organisation in proper delegation of authority for the attainment of the vision and mission of the business.

(2) Need of the Management: Management Accounting plays the role in meeting the need of the management

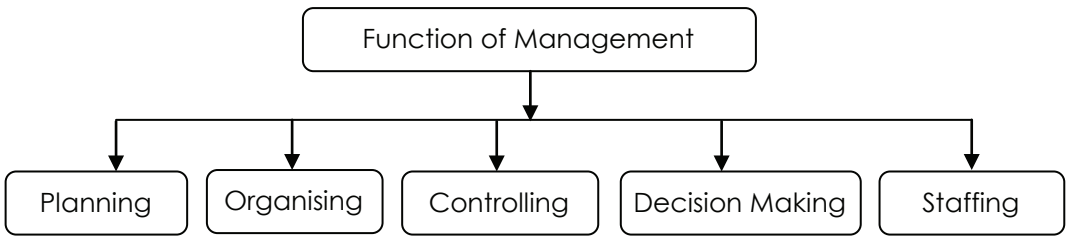
(3) Qualitative Information: Management Accounting accumulates the qualitative information so that management would concentrate on the actual issue to deliberate and attain the specific conclusion even for the complex problem.

(4) Objective of the Business: Management Accounting provides measure and reports to the management thereby facilitating in attainment of the objective of the business.

ROLE OF MANAGEMENT ACCOUNTING IN MANAGEMENT PROCESS

The role of Management Accounting is significant in making the firm both efficient and effective. Management Accounting has brought out clear shift in the objective of accounting. From mere recording of transactions, the emphasis is on analyzing and interpreting to help the management to secure better results. In this way, Management Accounting eliminates intuition, which is not at all dependable, from the field of business management to the cause and effect approach.

It is well known the basic functions of management are:
1. Planning,
2. Organising,
3. Controlling,
4. Decision-making and
5. Staffing



Management accounting plays a vital role in the managerial functions performed by the managers.

(1) **Planning:** Planning is the real beginning of any activity. Planning establishes the objectives of the firm and decides the course of action to achieve it. It is concerned with formulating short-term and long-term plans to achieve a particular end. Planning is a statement of what should be done, how it should be done and when it should be done. While planning, management accountant uses various techniques such as budgeting, standard costing, marginal costing etc for fixing targets. For example, if a firm determines to

achieve a particular level of profit, it has to plan how to reach the target. What products are to be sold and at what prices? The Management Accountant develops the data that helps managers to identify more profitable products. What are the different ways to improve the existing profits by 25%? Management Accounting throws various alternatives to achieve the goal.

(2) **Organising:** Organising is a process of establishing the organizational framework and assigning responsibility to people working in the organization for achieving business goals and objectives. The organizational structure may not be the same in all organizations, some may have centralized, while others may be decentralized structures. The management accountant may prepare reports on product lines, based on which managers can decide whether to add or eliminate a product line in the current product mix.

(3) **Controlling:** Control is the process of monitoring, measuring, evaluating and correcting actual results to ensure that a firm's goals and plans are achieved. Control is achieved through the process of feedback. Feedback allows the managers to allow the operations continue as they are or take corrective action, by some rearranging or correcting at midstream. The use of performance and control reports serve the function of controlling. For example, a production supervisor may receive weekly or daily performance reports, comparing actual material cost with planed costs. Significant variances can be isolated for corrective action. In the normal course, periodical reports are submitted, appraising the performance against the targets set. Reports for action are given to the top management, following the principle of management by exception. Performance and control reports do not tell managers what to do. These feedback reports identify, where attention is needed to help managers to determine the required course of action.

(4) **Decision-making:** Decision-making is a process of choosing among competing alternatives. Decision-making is inherent in all the above three functions of management-planning, organizing and controlling. There may be different methods or objectives. The manager can plan or choose only one of the competing plans. Similarly, in organizing, decision can be made whether the organizational structure should be centralized or decentralized. In control function, manager can decide whether variance is worthy to investigate or not.

(5) **Staffing:** Staffing is the process of recruitment, selection, development, training, compensation and overseeing employee in an organisation. Staffing, like all other managerial functions, is the duty which is vest on the management to perform. The role of the management accounting in this regard is manning the entity structure through proper and effective selection, appraisal, and development of the personnel to fill the role assigned to the employer. Moreover, the management accountants have to reduce the labour turnover and to control the overall employee cost.

FINANCIAL MANAGEMENT

❖ **Introduction**

Finance is called "The science of money". It studies the principles and the methods of obtaining control of money from those who have saved it, and of administering it by those into whose control it passes. Finance is the process of conversion of accumulated funds to productive use. It is so intermingled with other economic forces that there is difficulty in appreciating the role of it plays. Howard and Uptron in his book introduction to Business Finance defined, "as that administrative area or set of administrative function in an organization which relate with the arrangement of cash and credit so that the organization may have the means to carry out its objectives as satisfactorily as possible".

❖ **Meaning**

Financial Management is managerial activity which is concerned with the planning and controlling of the firm's financial resources.

❖ **Definitions:**

Howard and Uptron define Financial Management "as an application of general managerial principles to the area of financial decision-making".

Weston and Brighem define Financial Management "as an area of financial decision making, harmonizing individual motives and enterprise goal".

❖ **Objective of Financial Management**

Financial Management as the name suggests is management of finance. It deals with planning and

mobilization of funds required by the firm. Financial Management deals with activities which have financial implications. This prime objective of Financial Management is reflected in the EPS (Earning per Share) and the market price of its shares. The earlier objective of profit maximization is now replaced by wealth maximization. Since profit maximization is a limited one it cannot be the sole objective of a firm. The term profit is a vague phenomenon and if given undue importance problems may arise whereas wealth maximization on the other hand overcomes the drawbacks of profit maximization.

❖ **Profit Maximization versus Wealth Maximization**

Financial Management is basically concerned with procurement and use of funds. In the light of these, the main objectives of Financial Management are: -

1. Profit Maximization.
2. Wealth Maximization

1. Profit maximization:

Profit Maximization is the main objective of business because:

(i) Profit acts as a measure of efficiency and

(ii) It serves as a protection against risk.

• Agreements in favour of Profit Maximization:

(i) When profit earning is the main aim of business the ultimate objective should be profit maximization.

(ii) The main source of finance for growth of a business is profit. Hence, profit maximization is required.

(iii) Profit maximization is justified on the grounds of rationality as profits act as a measure of efficiency and eco¬nomic prosperity.

• Arguments against Profit Maximization:

(i) It leads to exploitation of workers and consumers.

(ii) It ignores the risk factors associated with profit.

(iii) Profit in itself is a vague concept and means differently to different prople.

Thus, profit maximization as an objective of Financial Management has been considered inadequate.

2. Wealth Maximization:

Wealth Maximization is considered as the appropriate objective of an enterprise. When the firm maximizes the stock holder's wealth, the individual stockholder can use this wealth to maximize his individual utility. Wealth Maximization is the single substitute for a stock holder's utility.

A Stock holder's wealth is shown by:

Stock holder's wealth = No. of shares owned x Current stock price per share Higher the stock price per share, the greater will be the stock holder's wealth.

Arguments in favour of Wealth Maximization:

(i) Due to wealth maximization, the short term money lenders get their payments in time.

(ii) The long time lenders to get a fixed rate of interest on their investments.

(iii) The various resources are put to economical and efficient use.

Argument against Wealth Maximization:

(i) It is socially undesirable.

(ii) It is not a descriptive idea.

(iii) The objective of wealth maximization is endangered when ownership and management are separated.

In spite of the arguments against wealth maximization, it is the most appropriative objective of a firm.

Decision Making

❖ **Decision-making in organizations**

Decision-making is a part of our everyday life and we all need to make decisions either consciously or unconsciously at work and in our personal life. This decision we make may be based on facts, experience and/or intuition. The forming of prefer¬ences, identities, rules, situations, and expectations all involve making sense out of a confusing organisational world. Hence, as organizations make decisions, they transform their preferences and their identities and shape the world they interpret. Therefore, as Greenberg & Baron (2008) state making decisions is one of the most important and critical activities of organizations, because organizations as systems build themselves up by making decisions. Decision-making and its role in organizations can be viewed in a number of ways. The decision-making theory used in this study will focus on a combination of two disciplines: managerial decision-making and knowledge management. The aim of the theory is to support the study findings and informed managerial decision-making.

❖ **Managerial decision-making**

Organizations are made of people - people are the organization. Managers are in the organizations' the people who have to take most of the decisions, both day-to-day and strategically, about how the scarce resources within their control are to be used to reach the organi¬zational goals. Thus, making decisions is considered to be one of the most crucial man¬agement activities, defined as the choice making process among several activities. The objective of this decision-making process is to move the situation from the current state to some desired future state.

❖ **The decision-making process**

The decision context and type can vary and the outcome is often dependant on the de¬cision maker. Although, in sequential models there are some common steps that can be identified included to nearly every decision. Drury (2008) describes the decision-making process, visualised in Figure 7, as compris¬ing of five stages which belong to the decision-making (or planning) process, followed by two final stages which represent the control process.

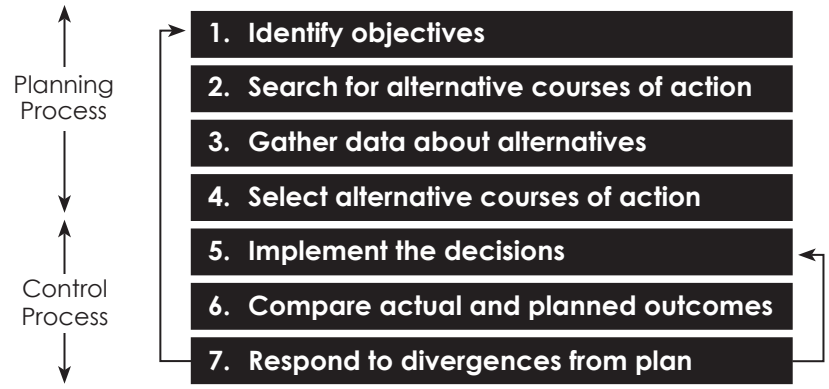


Figure 7: The decision-making, planning and control process (Drury, 2008, p. 8)

An intuitive sense of good decision-making seems to be natural for some managers. However, the reality tends to be that consistently good decision-making is rarely based on intuition only. But to support is required diligent accumulation and evaluation of infor¬mation. This is where management accounting comes in, providing the information needed to fuel the decision-making process.

2 RELEVANT COSTING FOR DECISION MAKING

Relevant Cost

Relevant cost is expected future cost which differs for alternative course. They are not historical cost but future costs to be associated withe different inputs and activities related a particular business decision. Usually variable costs are relevant while fixed cost are non-relevant. Ex. Make or Buy, Special Pricing.

However, It is not essential that all variable cost are relevant and all fixed cost are irrelevant. Fixed or variable costs that differ for various alternatives are relevant costs.

E.g. 1) Fixed Cost for project X is Rs. 5 lakhs and for alternative project Y it is 7 lakhs. therefore fixed cost is relevant in this example.

E.g. 2) Direct material under alternative I- Rs. 150 per Kg. Direct material under alternative II- Rs. 150 per Kg. therefore variable cost is not relevant in this example.

SUNK COSTS

Sunk costs are all costs incurred or committed in the past that cannot be changed by any decision made now or in the future. Sunk costs should not be considered in decisions.

Sunk costs have been incurred and cannot be reversed. Historical costs are sunk costs. They play no role in decision making in the current period. Sunk Cost do not affect future costs and cannot be changed by any current or future action, hence these costs are irrelevant in decision making.

Ex. Spending on advertising during product launching is sunk for taking a decision on continuance of product.

Make / Buy

Very often make-or-buy decision is the act of making a tactical choice between producing an item internally and buying it from an outside supplier.

Under such circumstances two factors are to be considered:

- whether surplus capacity is available and
- the marginal cost.

Elements of the "make" analysis include:

- Incremental inventory-carrying costs.
- Direct labor costs.
- Incremental factory overhead costs.
- Delivered purchased material costs.
- Incremental managerial costs.

Cost considerations for the "buy" analysis include :

- Purchase price of the part.
- Transportation costs.
- Receiving and inspection costs.

- Incremental purchasing costs.
- Any follow-on costs related to quality or service.

Shutdown Cost

Some times it becomes necessary for a company to temporarily close down the factory or unit because of trade downturn with view to reopening it in the future. In this situation decisions are based on the variable cost analysis.

If selling price is above the variable cost then it better to continue because the losses are minimized.

By closing the manufacturing activity, some extra fixed expenses (e.g. Security) may be incurred and certain fixed expenses can be avoided (e.g. maintenance cost of plant). Such costs are also relevant.

The decision is based on as to whether the contribution is more than the difference between fixed expenses incurred in normal operation and the fixed expenses incurred when the plant is shut down.

Introducing new Product

There are two reasons why a commercial enterprise should undertake the time, effort, and expense of introducing a new product or service:

1. customers have shown interest.
2. demand is sufficient and sustainable enough for the proposed product to make a profit.

In other words, successful enterprises sell what customers want to buy rather than what the entrepreneur wants to sell.

All relevant costs should be recovered over a period of product life.

Joint Product

When two or more products of equivalent importance are produced simultaneously, they are termed as joint products.

In other words two or more products separated in course of the same processing operation, each product being in such proportion that no single product can be designated as a major product.

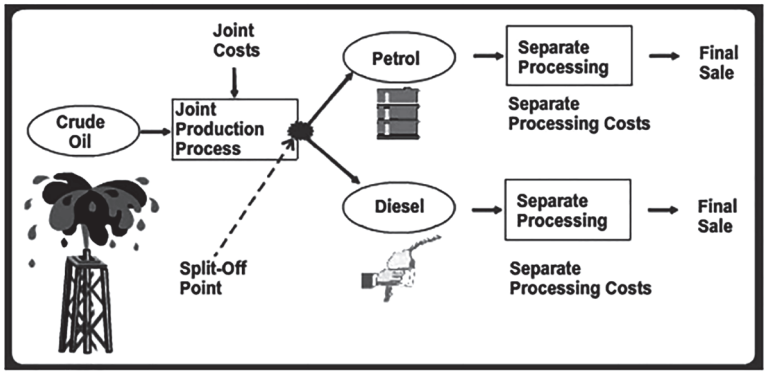
Joint Products usually require further processing.

Joint Products.

in Coke production, Coal is raw material with Coke, Sulfate of ammonia, light oil asjoint products.

E.g. Refining Process, where crude oil is raw material gives Petrol, Diesel, Gas as Joint Products.

Joint Product Cost Allocation



By Product

By Product is product of relatively small total value that is produced simultaneously with a product of greater total value. The product with the greater value (Main product), is usually produced in greater quantities than the By Product.

In other words, when two or more products are separated in course of the same processing operation, where one of the products being in such proportion/ value that it can be designated as a Main product, while others

are considered as By Products.

ex. of By-products in coke manufacture - gas and tar in lumber mills - sawdust.

cotton cleaning process - cotton seed coconut oil industry - coca shells.

Terminology

Joint Product Process:

A process that results in production of two or more products, which are termed as joint products.

Joint product cost:

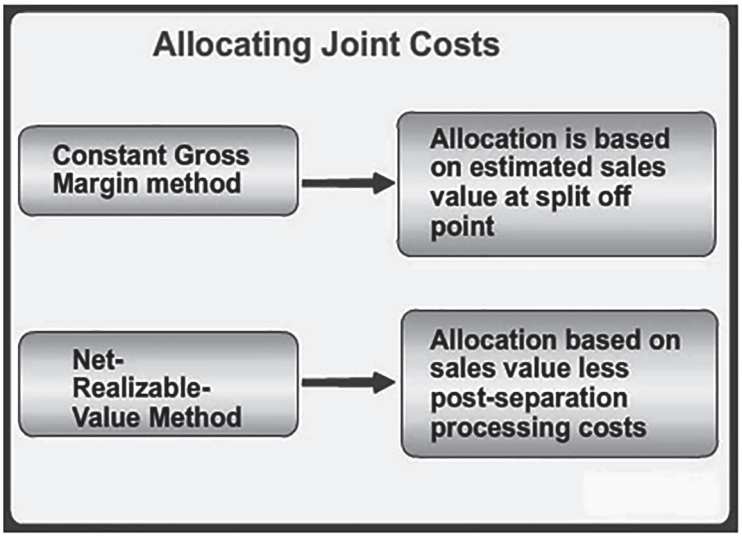
The cost of the raw materials/input and the joint production process.

Split Off Point:

The point in the production process where the individual products become separately identifiable.

Joint Cost Allocation: Methods

- Physical units method.
- Relative Sales Value Method.
- Sale value at split off point.
- Net Realisable value method.



RELEVANT COSTS AND DECISION MAKING

Relevance is one of the key characteristics of good management accounting information. This means that management accounting information produced for each manager must relate to the decisions which he/she will have to make.

'Relevant costs' are the costs that meet this requirement of good management accounting information. The Chartered Institute of Management Accounting defines relevant costs as:

'the costs appropriate to a specific management decision'

This definition could be restated as 'the amount by which costs increase and benefits decrease as a direct result of a specific management decision'. Relevant benefits are 'the amounts by which costs decrease and benefits increase as a direct result of a specific management decision'.

Identifying relevant and non-relevant costs

The identification of relevant and non-relevant costs in various decision-making situations is based primarily on common sense and the knowledge of the decision maker of the area in which the decision is being made. Armed with these two tools you should be able to sift through all the information that is available in respect of

any decision and extract those costs (and benefits) which are appropriate to the decision at hand.

In identifying relevant costs for various decisions, you may find that some costs not included in the normal accounting records of an enterprise are relevant and some costs included in such records are non-relevant. It is important that you realise that there is a substantial difference between recorded accounting costs and relevant costs for decision making, and while the latter may be recorded in the former this is not always the case. Accounting records are used to record the incidence of actual costs and revenues as they arise. Decisions, on the other hand, are based only on the relevant costs and benefits appropriate to each decision while the decision is being made. This point is particularly appropriate when you come to examine opportunity costs and sunk costs that are dealt with below.

Evaluating decisions involving relevant and non-relevant costs

When you are faced with making a decision, you have to perform two tasks before making the final decision:

1. Evaluate the options in the decision on a monetary basis using cost versus benefit analysis.
2. Take account of the qualitative factors associated with each option in the decision.

The performance of the first task is dealt with in this section. Performance of the second task is influenced by experience and common sense.

Nearly all decisions you will ever make will involve some relevant and non-relevant costs. As stated earlier the hardest part of the evaluation process will be the identification of the relevant costs for the decision at hand. This identification is often required from a plethora of information that you will have to carefully sift through to ensure the completeness of your evaluation.

Once the relevant costs are identified for each option you simply perform a cost versus benefit analysis for each option and select the one that results in the greatest gain or least cost to the enterprise.

It is important to note that, in practice, qualitative factors can result in a different option being selected than that suggested by the quantitative evaluation.

3 UNIFORM COSTING AND INTER-FIRM COMPARISON

UNIFORM COSTING IN PROFIT PLANNING

Introduction:

Uniform Costing is not a separate method or type of Costing. It is a technique of Costing and can be applied to any industry. *Uniform Costing may be defined as the application and use of the same costing principles and procedures by different organisations under the same management or on a common understanding between members of an association*. The main feature of uniform costing is that whatever be the method of costing used, it is applied uniformly in a number of concerns in the same industry, or even in different but similar industries. This enables cost and accounting data of the member undertakings to be compiled on a comparable basis so that useful and crucial decisions can be taken. The principles and methods adopted for the accumulation, analysis, apportionment and allocation of costs vary so widely from concern to concern that comparison of costs is rendered difficult and unrealistic. Uniform Costing attempts to establish uniform methods so that comparison of performances in the various undertakings can be made to the common advantage of all the constituent units.

Scope of Uniform Costing:

Uniform Costing methods may be advantageously applied:

(a) In a single enterprise having a number of branches or units, each of which may be a separate manufacturing unit.

(b) In a number of concerns in the same industry bound together through a trade association or otherwise, and

(c) In industries which are similar in nature such as gas and electricity, various types of transport, and cotton, jute and woolen textiles.

The need for application of Uniform Costing System exists in a business, irrespective of the circumstances and conditions prevailing therein. In concerns which are members of a trade association, the procedure for Uniform Costing may be devised and controlled by the association or by any other central body specially formed for the purpose.

Requisites for Installation of a Uniform Costing System:

The organisational set up for implementing the principles and methods of Uniform Costing may take different forms. It may range from a small association of a number of concerns who agree to have uniform information regarding a few specific cost accounting respects, to be a large organisation which has a fully developed scheme covering all the aspects of costing. The success of a uniform costing system will depend upon the following:

(a) There should be a spirit of mutual trust, co-operation and a policy of give and take amongst the participating members.

(b) There should be a free exchange of ideas and methods.

(c) The bigger units should be prepared to share with the smaller ones, improvements, achievements of efficiency, benefits of research and know-how.

(d) There should not be any hiding or withholding of information.

(e) There should be no rivalry or sense of jealousy amongst the members.

In the application of Uniform Costing, the fundamental requirement is, therefore, to locate such differences and to eliminate or overcome, as far as practicable, the causes giving rise to such differences. The basic reasons for the differences may be as follows:

(a) Size and organisational set up of the business:

The number and size of the departments, sections and services also vary from one concern to another according to their size and organisation. The difficulty in operating Uniform Cost Systems for concerns which vary widely in regard to size and type of business may to some extent be overcome by arranging the various units in a number of size or type ranges, and applying different uniform systems for each such type.

(b) Methods of production:

The use of different types of machines, plant and equipments, degree of mechanization, difference in materials mix and sequence and nature of operations and processes are mainly responsible for the difference in costs.

(c) Methods and principles of cost accounting applied:

It is in this sphere that the largest degree of difference arises. Undertakings manufacturing identical or similar products and having the same system of cost accounting would generally employ different methods of treatment of expenditure on buying, storage and issue of materials, pricing of stores issues, payment to workers, basis of classification and absorption of overhead, calculation of depreciation, charging rent on freehold or leasehold assets etc.

Fields covered by Uniform Costing:

There is no system of Uniform Costing which may be found to fit in all circumstances. The system to be installed should be tailored to meet the needs of each individual case. The essential *points* on which uniformity is normally required may be summarized as follows:

(a) Whether costs are required for the individual products i.e for the cost units or for cost centres.

(b) The method of costing to be applied.

(c) The technique employed such as Standard Costing, Marginal Costing.

(d) Items to be excluded from costs.

(e) The basis of departmentalization.

(f) The basis of allocation of costs to departments and/or service department costs to production departments.

(g) The methods of application administration, selling and distribution overhead to cost of sales.

(h) The method of valuation of work-in-progress.

(i) Methods of treating cost of spoilage, defective work, scrap and wastage.

(j) Methods of accounting of overtime pay bonus and other miscellaneous allowances paid to workers.

(k) Whether purchase, material handling and upkeep expenses are added to the cost of stores or are treated as overhead expenses.

(l) The system of materials control-pricing of issues and valuation of stock.

(m) The system of classification and coding of accounts.

(n) The method of recording accounting information.

Advantages of Uniform Costing:

Main advantages of a Uniform Costing System are summarised below:

(i) It provides comparative information to the members of the organisation / association which may by them to reduce or eliminate the evil effects of competition and unnecessary expenses arising from competition.

(ii) It enables the industry to submit the statutory bodies reliable and accurate data which might be required

to regulate pricing policy or for other purposes.

(iii) It enables the member concerns to compare their own cost data with that of the others detect the weakness and to take corrective steps for improvement in efficiency.

(iv) The benefits of research and development can be passed on the smaller members of the association lead to economy of the industry as a whole.

(v) It provides all valuable features of sound cost accounting such as valued and efficiency of the workers, machines, methods, etc., current reports of comparing major cost items with the predetermined standards, etc.

(vi) It serves as a prerequisite to Cost Audit and inter firm comparison.

(vii) It avoids cut-throat completion by ensuring that competition among member units proceeds on healthy lines.

(viii) The process of pricing policy becomes easier when Uniform Costing is adopted.

Limitations of Uniform Costing:

(i) Uniform costing presumes the application of same principles and methods of Costing in each of the member firms. But individual units generally differ in respect of certain key factors and methods.

(ii) For smaller units the cost of installation and operation of Uniform Costing System may be more than the benefits derived by them.

(iii) Uniform costing may create conditions that are likely to develop monopolistic tendencies within the industry. Prices may be raised artificially and supplies curtailed.

(iv) If complete agreement between the members is not forthcoming, the statistics presented cannot be relied upon. This weakens the Uniform Costing System and reduces its usefulness.

PROBLEM & SOLUTION ON UNIFORM COSTING

The share of total production and the cost-based fair price computed separately for each of the four units in industry are as follows:

	₹ per unit			
Share of Production	40%	25%	20%	15%
Material Costs	150	180	170	190
Direct Labour	100	120	140	160
Depreciation	300	200	160	100
Other Overheads	300	300	280	240
	850	800	750	690
20% return on capital employed	630	430	350	230
Fair Price	1,480	1,230	1,100	920
Capital employed per unit is worked out as follows:				
Net Fixed Assets	3,000	2,000	1,600	1,000
Working Capital	140	150	150	150
Total	3,140	2,150	1,750	1,150

Indicate with reasons, what should be the Uniform Price fixed for the product.

Solution:

Computation of Uniform Price :

Weighted Average Cost= [850 x 40%] + [800 x 25%] + [750 x 20%] + [690 x 15%]

= 340 + 200 + 150 + 103.5

= ₹ 793.5

Weighted Average Return on Capital Employed (profit)

= [628 x 40%] + [430 x 25%] + [350 x 20%] + [230 x 15%]

= 251.20 + 107.5 + 70 + 34.5

= ₹463.20

Uniform Price = 793.5 + 463.20 = ₹ 1,256.70

INTER FIRM COMPARISON

Inter-firm comparison as the name denotes means the techniques of evaluating the performances, efficiencies, deficiencies, costs and profits of similar nature of firms engaged in the same industry or business. It consists of exchange of information, voluntarily of course, concerning production, sales cost with various types of break-up, prices, profits, etc., among the firms who are interested of willing to make the device a success. The basic purposes of such comparison are to find out the work points in an organisation and to improve the efficiency by taking appropriate measures to wipe out the weakness gradually over a period of time.

The benefits which are derived from Inter-firm Comparison are appended below :

(a) Inter-firm Comparison makes the management of the organisation aware of strengths and weakness in relation to other organisations in same industry.

(b) As only the significant items are reported to the Management time and efforts are not unnecessary wasted.

(c) The management is able to keep up to data information of the trends and ratios and it becomes easier for them to take the necessary steps for improvement.

(d) It develops cost consciousness among the members of the industry.

(e) Information about the organisation is made available freely without the fear of disclosure of confidential data to outside market or public.

(f) Specialized knowledge and experience of professionally run and successful organisations are made available to smaller units who can take the advantages it may be possible for them to have such an infrastructure.

(g) The industry as a whole benefits from the process due to increased productivity, standardization of products, elimination of unfair comparison and the trade practices.

(h) Reliable and collective data enhance the organising power in deal in with various authorities and Government bodies.

(i) Inter firm comparison assists in a big way in identifying industry sickness and gives a timely warning so that effective remedial steps can be taken to save the organisation.

Limitations of Inter-firm Comparison:

The practical difficulties that are likely to arise in the implementation of a scheme of inter-firm comparison are:

(a) The top management may not be convinced of the utility of inter-firm comparison.

(b) Reluctance to disclose data which a concern considers to be confidential.

(c) A sense of complacence on the part of the management who may be satisfied with the present level of profits.

(d) Absence of a proper system of Cost Accounting so that the costing figures supplied may not be relied upon for comparison purposes.

(e) Non-availability of a suitable base for comparison.

These difficulties may be overcome to a large extent by taking the following steps:

(a) 'Selling' the scheme through education and propaganda. Publication of articles in journals and periodicals, and lecturers, seminars and personal discussions may prove useful.

(b) Installation of a system which ensures complete secrecy.

(c) Introduction of a scientific cost system.

SEPARATE COST RECORDS VIA-A-INTEGRAL ACCOUNTING

Items Excluded from Cost Accounts

There are certain items which are included in financial accounts of a manufacturing concern but shall not to be included in cost accounts since they are not related to cost of production. These items fall into three categories:-

Appropriation of profits:

(i) Appropriation to sinking funds.

(ii) Dividends paid

(iii) Taxes on income and profits

(iv) Transfers to general reserves

(v) Excess provision for depreciation of buildings, plant etc. and for bad debts

(vi) Amount written off – goodwill, preliminary expenses, underwriting commission, discount on debentures issued; expenses of capital issue etc.

(vii) Capital expenditures specifically charged to revenue

(viii) Charitable donation

Matters of pure finance

(a) Purely financial charges:-

(i) Losses on sale of investments, buildings, etc.

(ii) Expenses on transfer of company's office

(iii) Interest on bank loan, debentures, mortgages, etc.

(iv) Damages payable

(v) Penalties and fines

(vi) Losses due to scrapping of machinery

(vii) Remuneration paid to the proprietor in excess of a fair reward for services rendered.

(b) Purely financial incomes:-

(i) Interest received on bank deposits

(ii) Profits made on the sale of investments, fixed assets, etc.

(iii) Transfer fees received

(iv) Rent receivable

(v) Interest, dividends, etc. received on investments.

(vi) Brokerage received

(vii) Discount, commission received

Abnormal gains and losses:-

(i) Losses or gains on sale of fixed assets.

(ii) Loss to business property on account of theft, fire or other natural calamities.

In addition to above abnormal items (gain and losses) may also be excluded from cost accounts. Alternatively, these may be taken to costing profit and loss account.

INTEGRAL ACCOUNTING

Integrated accounting system is the name given to a system of accounting, where by cost and financial accounts are kept in the same set of books. Obviously, then there will be no separate set of books for costing and financial records. Integral accounts provide or meet the information required by costing and financial accounts.

Features of Integrated Accounting System:

(a) Complete analysis of costs and sales are kept.

(b) Complete details of all payments in cash are kept.

(c) Complete details of all assets and liabilities are kept and this system does not use a notional accounts to represent all impersonal accounts.

(d) Under this system, general ledger adjustment is not at all maintained and detailed accounts of assets and liabilities are maintained.

Advantages of integrated accounting system:

The main advantages of integrated accounts are as follows

(a) No need for Reconciliation: The question of reconciling costing profit and financial profit does not arise, as there is one figure of profit only

(b) Significant saving in the clerical efforts, as only one set of books is maintained.

(c) Retrieving of information is easy & quick

(d) It is economical also as it is based in the concept of centralization of accounting function

Essential pre-requisites for integrated accounts:

The essential pre-requisites for integrated accounts include the following steps

(a) The managements decision about the extent of integration of the two sets of books, some concerns find it useful to integrate upto the stage of primary cost or factory cost, while others prefer full integration of the entire accounting records.

(b) A suitable coding system must be made available so as to serve the accounting purposes of financial and cost accounts.

(c) An agreed routine, with regard to the treatment of provision for accruals, prepaid expenses, other adjustment necessary for preparation of interim accounts.

(d) Perfect coordination should exist between the staff responsible for the financial and cost aspects of the accounts and an efficient processing of accounting documents should be ensured.

The following table shows the comparative journal entries in financial accounts, cost accounts and integral accounts:

Sl. No.	Transaction	Financial Accounts	Cost Accounts	Integral Accounts
(i)	Credit purchase of Material	Purchases A/c Dr To, Creditors A/c	Material Control A/c Dr To, General Ledger A/c	Material Control A/c Dr To, Creditors
(ii)	Cash purchase of materials	Purchases A/c Dr To, Bank / Cash. A/c	Material Control A/c Dr To, General Ledger A/c	Material Control A/c Dr To, Cash
(iii)	Purchase of special material for direct use in job	Purchases A/c Dr To, Cash / Creditors. A/c	WIP Control A/c Dr To, General Ledger Adj A/c	WIP Contrtol A/c Dr To, Cash or Creditors A/c
(iv)	Purchase of materials for repairs	Purchases A/c Dr To, Cash/Creditors. A/c	Factory OH control A/c Dr To, General Ledger Adj A/c	Factory OH control A/c Dr To, Cash / Creditors A/c
(v)	Materials returned to suppliers	Creditors A/c Dr To, Purchases A/c	General Ledger Control A/c. Dr To Material control A/c	Creditors A/c Dr To, Material Control A/c
(vi)	Payments to creditors for supplies made	Creditors A/c Dr To, Cash A/c	No Entry	Creditors A/c Dr To, Cash A/c
(vii)	Issue of direct materials to production shops	No Entry	WIP Control A/c Dr To, Materials Control A/c	WIP Control A/c Dr To, Materials Control A/c
(viii)	Issue of indirect materials to production shops	No Entry	Factory OH Control A/c Dr To, Material Control A/c	Factory OH control A/c Dr To, Material Control A/c

Sl. No.	Transaction	Financial Accounts	Cost Accounts	Integral Accounts
(ix)	Return of direct materials to stores	No Entry	Material Control A/c Dr To, WIP Control A/c	Material Control A/c Dr To, WIP Control A/c
(x)	Return of indirect materials to stores	No Entry	Material Control A/c Dr To, Factory Overheads A/c	Material Control A/c Dr To, Factory Overheads A/c
(xi)	Materials transferred from one Job to another	No Entry	No Entry	No Entry
(xii)	Adjustment of normal depreciation in material stocks	No Entry	Factory Overheads Control A/c Dr To, Material Control A/c	Factory Overheads Control A/c Dr To, Material Control A/c
(xiii)	Adjustment of normal surplus in material stocks	No Entry	Material Control a/c Dr To, Factory OH Control A/c	Material Control A/c Dr To, Factory OH Control A/c
(xiv)	Payment of wages & Salaries	Wages & Salaries A/c Dr To Cash / Bank A/c	Wages Control A/c Dr To, General Ledger A/c	Wages & Salaries A/c Dr To, Cash / Bank A/c
(xv)	Analysis of distribution of wages	No Entry	WIP Control A/c Dr POH Control A/c Dr Admin OH Control A/c Dr Sellings Dis OH Control A/c Dr To, Wages Control A/c.	WIP Control A/c Dr POH Control A/c Dr Admin OH Control A/c Dr Sellings Dis OH Control A/c Dr To, Wages Control A/c.
(xvi)	Payment of Expenses	Expenses A/c Dr To, Cash A/c	POH Control A/c Dr Admin OH Control A/c Dr Selling & Dis OH Control A/c Dr To, General Ledger Adj A/c	POH Control A/c Dr Admin OH Control A/c Dr Selling & Dis OH Control A/c Dr To, Cash A/c
(xvii)	Recording of Depreciation	Depreciation A/c Dr To, Asset A/c	POH Control A/c Dr Admin OH Control A/c Dr Selling & Dis OH Control A/c Dr To, General Ledger Adj A/c	POH Control A/c Dr Admin OH Control A/c Dr Selling & Dis OH Control A/c Dr To, Asset A/c
(xviii)	Absorption of Factory Overheads	No Entry	WIP Control A/c Dr To, Factory Overheads A/c	WIP Control A/c Dr To, Factory Overheads A/c
(xix)	Spoiled / Defective Work	No Entry	Costing Profit & Loss A/c Dr To, WIP Control A/c	Costing Profit & Loss A/c Dr To, WIP Control A/c
(xx)	Recording of Cost of Jobs completed	No Entry	Finished Goods Control A/c Dr To, WIP Control A/c	Finished Goods Control A/c Dr To, WIP Control A/c
(xxi)	Recording of Cost of goods sold	No Entry	Cost of Sales A/c Dr To, Finished goods A/c	Cost of Sales A/c Dr To, Finished goods Control A/c
(xxii)	Recording of sales	Cash/ Debtor A/c Dr To, Sales A/c	General Ledger Control A/c Dr To, Costing P&L A/c	Cash / Debors A/c Dr To, P&L A/c
(xxiii)	Absorption of Administration Overheads	No Entry	Finished Goods Control A/c Dr To, Admin OH Control A/c	Finished Goods Control A/c Dr To, Admin OH control A/c
(xxiv)	Absorption of Selling Overheads	No Entry	Cost of Sales A/c Dr To, Selling & Dis. Overheads Control A/c	Cost of Sales A/c Dr To, Selling & Dis. OH Control A/c
(xxv)	Under absorption of overheads	No Entry	Costing Profit & Loss A/c Dr To, OH Control A/c	Profit & Loss A/c Dr To, OH control A/c

Sl. No.	Transaction	Financial Accounts	Cost Accounts		Integral Accounts	
(xxvi)	Over absorption of overheads	No Entry	OH Control A/c To, Costing P&L A/c	Dr	OH Control A/c To, Costing P&L A/c	Dr

Illustration 1 :

Journalise the following transactions assuming that cost and financial accounts are integrated:

Particulars	₹
Raw material purchased	40,000
Direct materials issued to production	30,000
Wages paid (30% indirect)	24,000
Wages charged to production	16,800
Manufacturing expenses incurred	19,000
Manufacturing overhead charged to Production	18,000
Selling and distribution cost	4,000
Finished products (at cost)	40,000
Sales	58,000
Closing stock	Nil
Receipts from debtors	13,800
payments to creditors	12,000

Solution:

Journals

		Dr.	Cr.
Particulars		₹	₹
Material Control A/c	Dr	40,000	
To, Creditors A/c			40,000
Work In Progress Control A/c	Dr	30,000	
To, Material Control A/c			30,000
Wages Control A/c	Dr	24,000	
To, Cash A/c			24,000
Factory Overheads Control A/c	Dr	7,200	
To, Wages Control A/c			7,200
Work-in-Progress Control A/c	Dr	16,800	
To, Wages Control A/c			16,800
Factory Overhead Control A/c	Dr	19,000	
To, Cash A/c			19,000
Work-in-Progress Control A/c	Dr	18,000	
To, Factory overhead Control A/c			18,000
S & D O.H. Control A/c	Dr	4,000	
To, Cash A/c			4,000
Cost of Sales A/c	Dr	4,000	
To, Selling & Distribution Overhead Control A/c			4,000
Finished Goods Control A/c	Dr	40,000	
To, Work-in-progress control A/c			40,000
Debtors A/c	Dr	58,000	
To, Profit & Loss A/c			58,000
Cash A/c	Dr	13,800	
To, Debtors A/c			13,800
Creditors A/c	Dr	12,000	
To, Cash A/c			12,000

Illustration 2 :

Pass the journal entries for the following transactions in a double entry cost accounting system:

	Particulars		₹
a)	Issue of material :	Direct	5,50,000
		Indirect	1,50,000
b)	Allocation of wages and salaries :	Direct	2,00,000
		Indirect	40,000
c)	Overheads absorbed in jobs :	Factory	1,50,000
		Administration	50,000
		Selling	30,000
d)	Under/over absorbed overheads :	Factory (Over)	20,000
	Admn . (Under)		10,000

Solution:

Journals

		Dr.	Cr.
Particulars		₹	₹
Work In Progress Control A/c	Dr	5,50,000	
Factory Overheads Control A/c	Dr	1,50,000	
To Material Control A/c			7,00,000
Work In Progress Control A/c	Dr	2,00,000	
Factory Overheads Control A/c	Dr	40,000	
To Wages Control A/c			2,40,000
Work In Progress Control A/c	Dr	1,50,000	
Finished goods Control A/c	Dr	50,000	
Cost of Sales A/c	Dr	30,000	
To Factory Overhead Control A/c			1,50,000
To Administrative Overhead Control A/c			50,000
To Selling Overhead Control A/c			30,000
Costing Profit & Loss A/c	Dr	10,000	
To Administrative Overhead Control A/c			10,000
Factory Overhead Control A/c	Dr	20,000	
To Costing Profit & Loss A/c			20,000

Illustration 3 :

Messsrs Essbee Ltd. maintains Integrated Accounts of Cost and Financial Accounts. From the following details write up Control Accounts of a factory and prepare a Trial Balance.

Particulars	₹
Share Capital	3,00,000
Reserve	2,00,000
Sundry Creditors	5,00,000
Plant and Machinery	5,75,000
Sundry Debtors	2,00,000
Closing Stock	1,50,000
Bank & Cash Balance	75,000

TRANSACTIONS DURING THE YEAR WERE AS FOLLOWS:

Particulars	₹
Stores purchased	10,00,000
stores issued to production	10,50,000

Stores in hand	95,000
Direct wages incurred	6,50,000
Direct wages charged to production	6,00,000
Manufacturing expenses incurred	3,00,000
Manufacturing expenses charged to production	2,75,000
Selling and distribution expenses	1,00,000
Finished stock production (at cost)	18,00,000
Sales at selling price	22,00,000
Closing stock	95,000
Payments to creditors	11,00,000
Receipts from debtors	21,00,000

Solution:

Dr. **Creditors Account** **Cr.**

Particulars	₹	Particulars	₹
To, Cash A/c	11,00,000	By, Balance b/d	5,00,000
To, Balance c/d	4,00,000	By, Material Control A/c	10,00,000
	15,00,000		**15,00,000**
		By, Balance b/d	4,00,000

Dr. **Debtors Account** **Cr.**

Particulars	₹	Particulars	₹
To, Balance b/d	2,00,000	By, Cash A/c	21,00,000
To, P & L A/c	22,00,000	By, Balance c/d	3,00,000
	24,00,000		**24,00,000**
To, Balance b/d	3,00,000		

Dr. **Material Control A/c (or) Stores Ledger Control Account** **Cr.**

Particulars	₹	Particulars	₹
To, Balance b/d	1,50,000	By, Work-in-Progress Control A/c	10,50,000
To, Creditors A/c	10,00,000	By, Manufacturing Overhead Control A/c	5,000
		By, Balance c/d	95,000
	11,50,000		**11,50,000**
To, Balance b/d	95,000		

Dr. **Cash & Bank Account** **Cr.**

Particulars	₹	Particulars	₹
To, Balance b/d	75,000	By, Wages Control A/c	6,50,000
To, Debtors A/c	21,00,000	By, Manufacturing Overhead Control A/c	3,00,000
		By, Selling and Distribution O.H. Control A/c	1,00,000
		By, Creditors A/c	11,00,000
		By, Balance c/d	25,000
	21,75,000		**21,75,000**
To, Balance b/d	25,000		

Dr. **Work-in-Progress Control Account** **Cr.**

Particulars	₹	Particulars	₹
To, Material Control A/c	10,50,000	By, Fixed Goods Control A/c	18,00,000
To, Wages Control A/c	6,00,000	By, Balance c/d	1,25,000
To, Manufacturing Overhead Control A/c	2,75,000		
	19,25,000		**19,25,000**
To, Balance b/d	1,25,000		

Dr. **Wages Control Account** **Cr.**

Particulars	₹	Particulars	₹
To Cash & Bank A/c	6,50,000	By, Work-in-Progress Control A/c	6,00,000
		By, Manufactures Overhead Control A/c	50,000
	6,50,000		**6,50,000**

Dr. **(Factory) Manufacturing Overhead Control Account** **Cr.**

Particulars	₹	Particulars	₹
To, Cash	3,00,000	By, Work-in-Progress Control A/c	2,75,000
To, Material Control A/c	5,000	By, Profit & Loss A/c	80,000
To, Wages Control A/c	50,000		
	3,55,000		**3,55,000**

Dr. **Selling & Distribution Overhead Control Account** **Cr.**

Particulars	₹	Particulars	₹
To, Cash A/c	1,00,000	By, Cost of Sales A/c	1,00,000
	1,00,000		**1,00,000**

Dr. **Finished goods Control Account** **Cr.**

Particulars	₹	Particulars	₹
To, Work-in-Progress Control A/c	18,00,000	By, Cost of Sales	17,05,000
		By, Balance c/d	95,000
	18,00,000		**18,00,000**
To, Balance b/d	95,000		

Dr. **Profit & Loss Account** **Cr.**

Particulars	₹	Particulars	₹
To, Factory Overheads Control A/c	80,000	By, Debtors A/c (Sale)	22,00,000
To, Cost of Sales	18,05,000		
To, Reserve A/c (Profit)	3,15,000		
	22,00,000		**22,00,000**

Dr. **Cost of Sales Account** **Cr.**

Particulars	₹	Particulars	₹
To, Selling & Distribution Control A/c	1,00,000	By, Profit & Loss A/c	18,05,000
To, Finished Goods Control A/c	17,05,000		
	18,05,000		**18,05,000**

Trial Balance

Particulars	Debit ₹	Credit ₹
Share Capital		3,00,000
Reserves		
(2,00,000 + 3,15,000)		5,15,000
Creditors		4,00,000
Plant & Machinery	5,75,000	
Debtors	3,00,000	
Closing Stock:		
Material	95,000	
Work-in-progress	1,25,000	
Finished goods	95,000	

Cash & bank	25,000	
	12,15,000	**12,15,000**

Illustration 4 :

The following balances are shown in the Cost Ledger of Vinak Ltd. as on 1st October, 2016:

Particulars	Dr. (₹)	Cr.(₹)
Work in progress Account	7,056	
Factory overheads suspense Account	360	
Finished stock Account	5,274	
Stores Ledger Control Account	9,450	
Administration Overheads Suspense A/C	180	
General Ledger Adjustment Account		22,320

Transactions for the year ended 30th september, 2017

Particulars	₹
Stores issued to production	45,370
Stores purchased	52,400
Material purchased for direct issued to production	1,135
Wages paid (including indirect labour ₹ 2,520)	57,600
Finished goods sold	1,18,800
Administration expenses	5,400
Selling expenses	6,000
Factory overheads	15,600
Store issued for Capital work-in-Progress	1,500
Finished goods transferred to warehouse	1,08,000
Store issued for factory repairs	2,000
Factory overheads recovered to production	16,830
Administration overheads charged to production	4,580
Factory overheads applicable unfinished work	3,080
selling overheads allocated to sales	5,500
Stores lost due to fire in store (not insured)	150
Administration expenses on unfinished work	850
Finished goods stock on 30.9.2016	14,274

You are required to record the entries in the cost ledger for the year ended 30th September, 2017 and prepare a Trial Balance as on that date.

Solution:

Dr. **Work-in-Progress Control Account** **Cr.**

Particulars	₹	**Particulars**		₹
To, Balance b/d	7,056	By, Finished Goods Control A/c		1,08,000
To, Material Control A/c	45,370	By, Balance c/d		
To, General Ledger Adjustment A/c	1,135	Factory Overhead	3,080	
To, Wages control A/c	55,080	Admn. O.H.	850	
To, Factory overhead control A/c	16,830	Material & Wages	22,051	25,981
To, Administrative Overhead Control A/c	4,580			
To, Factory Overhead Control A/c	3080			
To, Administrative Overhead Control A/c	850			
	1,33,981			**1,33,981**
To Balance b/d	25,981			

Dr. Factory Overhead Suspense Account Cr.

Particulars	₹	Particulars	₹
To, Balance b/d	360	By, Work-in-Progress Control A/c	3,080
To, Wages Control A/c	2,520	By, Work-in-Progress Control A/c	16,830
To, General Ledger Adjustment A/c	15,600	By, Balance c/d	570
To, Material Control A/c	2,000		
	20,480		**20,480**
To, Balance b/d	570		

Dr. Finished Goods Control Account Cr.

Particulars	₹	Particulars	₹
To, Balance b/d	5,274	By, Cost of Sales A/c	99,000
To, Work-in-progress Control A/c	1,08,000	By, Balance c/d	14,274
	1,13,274		**1,13,274**
To, Balance b/d	14,274		

Dr. Material Control Account Cr.

Particulars	₹	Particulars	₹
To, Balance b/d	9,450	By, Work-in-Progress Control A/c	45,370
To, General Ledger Adjustment A/c	52,400	By, Capital Work-in-Progress Control A/c	1,500
		By, Factory Overhead Suspense A/c	2,000
		By, Costing Profit & Loss A/c	150
		By, Balance c/d	12,830
	61,850		**61,850**
To, Balance b/d	12,830		

Dr. Administrative Overhead Control Account Cr.

Particulars	₹	Particulars	₹
To, Balance c/d	180	By, Work-in-Progress Control A/c	4,580
To, General Ledger Adjustment A/c	5,400	By, Work-in-Progress Control A/c	850
		By, Balance c/d	150
	5,580		**5,580**
To, balance b/d	150		

General Ledger Adjustment (GLA) Account

Dr. (or) Cost Ledger Control (CLC) Account Cr.

Particulars	₹	Particulars	₹
To, Costing Profit & Loss A/c	1,18,800	By, Balance b/d	22,320
To, Balance c/d	55,805	By, Material Control A/c	52,400
		By, Work-in-Progress Control A/c	1,135
		By, Wages Control A/c	57,600
		By, Administrative Overhead Control A/c	5,400
		By, Factory Overhead Control A/c	15,600
		By, Selling and Distribution Overhead Control A/c	6,000
		By, Costing Profit & Loss A/c	14,150
	1,74,605		**1,74,605**
		By Balance b/d	55,805

Dr. Wages Control Account Cr.

Particulars	₹	Particulars	₹
To, General Ledger Adjustment A/c	57,600	By, Work-in-Progress Control A/c	55,080

		By, Factory Overhead Control A/c	2,520
	57,600		**57,600**

Dr. **Costing Profit & Loss Account** **Cr.**

Particulars	₹	Particulars	₹
To, Material Control A/c	150	By, General Ledger Adjustment Control A/c (Sales)	1,18,800
To, Cost of Sales	1,04,500		
To, General Ledger Adjustment Control A/c (profit)	14,150		
	1,18,800		**1,18,800**

Dr. **Selling and Distribution Overhead Control Account** **Cr.**

Particulars	₹	Particulars	₹
To, General Ledger Adjustment A/c	6,000	By, Cost of Sales A/c	5,500
		By, Balance c/d	500
	6,000		**6,000**
To Balance b/d	500		

Dr. **Capital Work-in-progress Account** **Cr.**

Particulars	₹	Particulars	₹
To, Material Control A/c	1,500	By, Balance c/d	1,500
	1,500		**1,500**
To, balance b/d	1,500		

Dr. **Cost of Sales Account** **Cr.**

Particulars	₹	Particulars	₹
To, Selling & Distribution Control A/c	5,500	By, Costing Profit & Loss A/c	1,04,500
To, Finished Goods Control A/c	99,000		
	1,04,500		**1,04,500**

Trial Balance

Particulars	Debit ₹	Credit ₹
Work-in-Progress Control	25,981	
Factory overhead Suspense	570	
Finished Goods Control	14,274	
Material Control	12,830	
Administrative Overhead Control	150	
General Ledger Adjustment		55,805
Selling and Distribution Overhead Control	500	
Capital Work-in-Progress	1,500	
	55,805	**55,805**

RECONCILIATION OF COST ACCOUNTING RECORDS WITH FINANCIAL ACCOUNTS

Where no separate accounts are maintained for costing and finance, the question of reconciliation does not arise. But where the cost and financial accounts are maintained independently of each other, it is indispensable to reconcile them. Though both the sets of accounts are same as far as the basic transactions are concerned but there are differences in the profits of two sets of books.

Procedure for reconciliation

Take Profits as per Financial Accounts.

Add :

(a) Items of income included in Cost Accounts but not in Financial Accounts.

(b) Items of expenditure included in Financial and not in Cost Accounts.

(c) Amounts by which items of income have been shown in excess in Cost Accounts over the corresponding entries in Financial Accounts.

(d) Amounts by which items of expenditure have been shown in excess in Financial Accounts over the corresponding entries in Cost Accounts.

(e) Under absorption of overheads in Cost Accounts.

(f) The amount by which closing stock of inventory is overvalued in Cost Accounts.

(g) The amount by which opening stock of inventory is undervalued in Cost Accounts.

Less :

(a) Items of income included in Financial Accounts but not in Cost Accounts.

(b) Items of expenditure (as interest on Capital, Rent on owned premises etc.) included in Cost Accounts but not in Financial Accounts.

(c) Amounts by which items of expenditure have been shown in excess in Cost Accounts as compared to the corresponding entries in Financial Accounts.

(d) Amounts by which items of incomes have been shown in excess in Financial Accounts as compared to the corresponding entries in Cost Accounts.

(e) Over absorption of overheads in Cost Accounts.

(f) The amount by which closing stock of inventory is undervalued in Cost Accounts.

(g) The amount by which opening stock of inventory is overvalued in Cost Accounts.

Illustration 5 :

The net profits of a manufacturing company appeared at ₹ 64,500 as per financial records for the year ended 31st December, 2016. The cost books however, showed a net profit of ₹ 86,460 for the same period. A careful scrutiny of the figures from both the sets of accounts revealed the following facts.

		₹
(i)	Income-tax provided in financial books	20,000
(ii)	Bank Interest (Cr) in financial books	250
(iii)	Work overhead under recovered	1,550
(iv)	Depreciation charged in financial records	5,600
(v)	Depreciation recovered in cost	6,000
(vi)	Administrative overheads over-recovered	850
(vii)	Loss due to obsolescence charged in financial accounts	2,800
(viii)	Interest on Investments not included in cost accounts	4,000
(ix)	Stores adjustments (Credit in financial books)	240
(x)	Loss due to depreciation in stock value	3,350

Prepare Reconciliation Statement.

Solution:

Statement showing reconciliation of profit shown by cost and financial accounts as on 31-12-2016:

Particulars		Amount ₹	Amount ₹
Profit as per Financial Accounts			64,500
Add:	Income tax provided in financial books only.	20,000	
	Works overhead under recovered	1,550	
	Loss to obsolescence considered. Financial A/c only.	2,800	
	Loss due to depreciation in stock	3,350	27,700
			92,200
Less:	Bank interest credited in financial books.	250	
	Over recovery of depreciation	400	
	Administration OH's over recovered	850	
	Interest on investment not included in cost books	4,000	
	Stores adjustment	240	5,740
Profit as per Cost Accounts			86,460

Illustration 6 :

The net profits shown by financial accounts of a company amounted to ₹18,550 whilst the profits disclosed by company's cost account for that period were ₹ 28,660. On reconciling the figures, the following difference were noted.

		₹
(i)	Director's fee not charged in cost accounts	650
(ii)	A provision for bad and doubtful debts	570
(iii)	Bank interest (cr.)	30
(iv)	Income-tax	8,300

(v) Overheads in the cost accounts were estimated at ₹8,500. The charges shown by the financial books was ₹8,320.

(vi) Work was started during the year on a new factory and expenditure ₹16,000 was incurred. Depreciation of 5% was provided in financial accounts.

Prepare a Statement Reconciling the figures shown by the cost and financial accounts.

Solution:

Statement showing reconciliation of profit shown by cost and financial accounts

Particulars		Amount ₹	Amount ₹
Profit as per Financial Accounts			18,550
Add:	Directors fee	650	
	Provision for bad debts	570	
	Income tax	8,300	
	Depreciation in financial books only	800	10,320
			28,870
Less:	Bank interest	30	
	Over recovery of overheads	180	210
Profit as per Cost Accounts			28,660

Illustration 7:

M/s Mysore Petro Ltd. showed a net loss of ₹ 2,08,000 as per their financial accounts for the year ended 31st March, 2017. The cost accounts, however, disclosed a net loss of ₹1,64,000 for the same period. The following

information was revealed as a result of the scrutiny of the figures of both the sets of books.

		₹
(i)	Factory overhead under recovered	3,000
(ii)	Administration overhead over recovered	2,000
(iii)	Depreciation charged in financial books	60,000
(iv)	Depreciation recovered in costs	65,000
(v)	Interest on investment not included in costs	10,000
(vi)	Income-tax provided	60,000
(vii)	Transfer fee (in financial Books)	1,000
(viii)	Stores adjustment (credit in financial books)	1,000

Prepare Reconciliation Statement.

Solution:

Statement Showing Reconciliation of Profit Shown by Cost and Financial Accounts

Particulars		**Amount** ₹	**Amount** ₹
Profit as per Financial Accounts			(2,08,000)
Add:	Under recovery of factory overheads	3,000	
	Income tax	60,000	63,000
			(1,45,000)
Less:	Over recovery of Administration OH	2,000	
	Over recovery of depreciation	5,000	
	Interest on investments considered in Financial A/c	10,000	
	Transfer fee	1,000	
	Stores adjustment	1,000	19,000
Loss as per Cost Accounts			(1,64,000)

Illustration 8 :

During a particular year, the auditors certified the financial accounts, showing profit of ₹1,68,000 whereas the same, as per costing books was coming out to be ₹ 2,40,000. Given the following information you are asked to prepare a Reconciliation Statement showing the reasons for the gap.

Dr. **Trading and Profit and Loss Account** **Cr.**

Particulars	₹	Particulars	₹
To, Opening stock A/c	8,25,000	By, Sales	34,65,000
To, Purchases A/c	24,72,000	By, Closing stock A/c	7,50,000
To, Direct wages A/c	2,30,000		
To, Factory overhead A/c	2,10,000		
To, G.P. C/d	4,83,000		
	42,15,000		42,15,000
To, Admn.Expenses A/c	95,000	By, G.P. b/d	4,83,000
To, Selling Expenses A/c	2,25,000	By, Sundry Income A/c	5,000
To, Net profit	1,68,000		
	4,88,000		4,88,000

The costing records show:

(i) Book value of closing stock ₹7,80,000

(ii) Factory overheads have been absorbed to the extent of ₹1,89,800

(iii) Sundry income is not considered

(iv) Total absorption of direct wages ₹2,46,000

(v) Administrative expenses are covered at 3% of selling price.

(vi) Selling prices include 5% for selling expenses.

Solution:

Statement Showing Reconciliation of Profit Shown by Cost and Financial Accounts

Particulars	**Amount (₹)**	**Amount (₹)**
Profit as per Financial Accounts		1,68,000
Add: Over valuation of Closing stock in Cost Accounts (7,80,000 - 7,50,000)	30,000	
Under recovery of works overhead (2,10,000 - 1,89,800)	20,200	
Under recovery of selling expenses in Cost Accounts. (2,25,000 – 1,73,250*)	51,750	1,01,950
		2,69,950
Less: Sundry income not considered in Cost Accounts	5,000	
Over recovery of wages (2,46,000 - 2,30,000)	16,000	
Over recovery Administration expenses (1,03,950** - 95,000)	8,950	29,950
Profit as per Cost Accounts		2,40,000

***** 5% of 34,65,000 = 1,73,250

****** 3% of 34,65,000 = 1,03,950

Illustration 9 :

A transistor manufacturer, who commenced his business on 1st June, 2017 supplies you with the following information and asks you to prepare a statement showing the profit per transistor sold. Wages and materials are to be charged at actual cost, works overhead at 75% of wages and office overhead at 30% of works cost. Number of transistors manufactured and sold during the year was 540.

Other particulars:

Materials per set ₹ 240

Wages per set ₹ 80

Selling price per set ₹ 600

If the actual works expenses were ₹32,160 and office expenses were ₹61,800, prepare a Reconciliation Statement.

Solution:

Cost Sheet (or) Statement of Cost and Profit

Particulars	**Unit (₹)**	**Total (₹)**
Material	240	1,29,600
Wages	80	43,200
Prime cost	320	1,72,800
(+) Works overhead (75% of wages)	60	32,400
Works cost	380	2,05,200
(+) Office overheads (30% of work cost)	114	61,560
Total cost	494	2,66,760
(+) Profit	106	57,240
Sales	**600**	**3,24,000**

Dr. **Trading and Profit & Loss Account** **Cr.**

Particulars	Amount ₹	Particulars	Amount ₹
To, Materials A/c	1,29,600	By, Sales A/c	3,24,000
To, Wages A/c	43,200		
To, Works Overheads A/c	32,160		
To, Gross Profit	1,19,040		
	3,24,000		3,24,000
To, Office Expenses	61,800	By, Gross Profit b/d	1,19,040
To, Net Profit	57,240		
	1,19,040		1,19,040

Statement of Reconciliation

Particulars	Amount ₹
Profit as per Financial Accounts	57,240
(-) Over recovery of works overheads (32,160 - 32,400)	(240)
(+) Under recovery of office expenses (61,800 - 61,560)	240
Profit as per Cost Accounts	57,240

Illustration 10 :

Given below is the Trading and Profit and Loss Account of Vikas Electronics for the accounting year ended 31st March, 2017.

Dr. **Trading and Profit & Loss Account** **Cr.**

Particulars	₹	Particulars	₹
To, Direct Materials consumed	3,00,000	By, Sales A/c (2,50,000 units @ ₹ 3)	7,50,000
To, Direct Wages A/c	2,00,000		
To, Factory expenses A/c	1,20,000		
To, Office Expenses A/c	40,000		
To, Selling & Distribution Exp. A/c	80,000		
To, Net profit	10,000		
	7,50,000		7,50,000

Normal output of the factory is 2,00,000 units. Factory overheads are fixed upto ₹60,000 and office expenses are fixed for all practical purposes, selling and distribution expenses are fixed to the extent of ₹50,000 the rest are variable. Prepare a Statement of Reconciliation of Profit as per Cost Accounts and Financial Accounts.

Solution:

Cost Sheet (or) Statement of Cost and Profit

Particulars	Amount ₹	Amount ₹
Material consumed		3,00,000
Direct wages		2,00,000
Prime cost		5,00,000

(+) **Works/Factory expenses**		
Fixed (60,000 x 2,50,000/2,00,000)	75,000	
Variable (1,20,000 - 60,000)	60,000	1,35,000
Works cost		6,35,000
(+) Office expenses (40,000 x 2,50,000/2,00,000)		50,000
Cost of production		6,85,000
(+) **Selling & Distribution expenses**		
Fixed (50,000 x 2,50,000/2,00,000)	62,500	
Variable (1,20,000 - 60,000)	30,000	92,500
Cost of sales/Total cost		7,77,500
(-) Loss		(27,500)
Sales		7,50,000

Statement of Reconciliation

Particulars	**Amount** ₹	**Amount** ₹
Profit as per Financial Accounts		10,000
Add:		
Less: Over recovery of factory overheads (1,35,000 - 1,20,000)	15,000	
Over recovery of office expenses (50,000 - 40,000)	10,000	
Over recovery of Selling & Distribution overheads (92,500 - 80,000)	12,500	37,500
Loss as per Cost Accounts		27,500

4 TOTAL QUALITY MANAGEMENT (TQM)

INTRODUCTION :

Everyone has had experiences of poor quality when dealing with business organizations. These xperiences might involve an airline that has lost a passenger's luggage, a dry cleaner that has left lothes wrinkled or stained, poor course offerings and scheduling at your college, a purchased product that is damaged or broken, or a pizza delivery service that is often late or delivers the wrong order. The experience of poor quality is exacerbated when employees of the company either are not empowered to correct quality inadequacies or do not seem willing to do so.We have all encountered service employees who do not seem to care. The consequences of such an attitude are lost customers and opportunities for competitors to take advantage of the market need. Successful companies understand the powerful impact customer-defined quality can have on business. For this reason many competitive firms continually increase their quality standards. For example, both the Ford Motor Company and the Honda Motor Company have recently announced that they are making customer satisfaction their number one priority. The slow economy of 2003 impacted sales in the auto industry. Both firms believe that the way to rebound is through improvements in quality, and each has outlined specific changes to their operations. Ford is focusing on tightening already strict standards in their production process and implementing a quality program called Six-Sigma. Honda, on the other hand, is focused on improving customer-driven product design. Although both firms have been leaders in implementing high quality standards, they believe that customer satisfaction is still what matters most.

In this chapter you will learn that making quality a priority means putting customer needs first. It means meeting and exceeding customer expectations by involving everyone in the organization through an integrated effort.

TOTAL QUALITY MANAGEMENT

(TQM) is an integrated organizational effort designed to improve quality at every level. In this chapter you will learn about the philosophy of TQM, its impact on organizations, and its impact on your life. You will learn that TQM is about meeting quality expectations as defined by the customer; this is called customer-defined quality. However, defining quality is not as easy as it may seem, because different people have different ideas of what constitutes high quality. Let's begin by looking at different ways in which quality can be defined.

DEFINING QUALITY

The definition of quality depends on the role of the people defining it. Most consumers have a difficult time defining quality, but they know it when they see it. For example, although you probably have an opinion as to which manufacturer of athletic shoes provides the highest quality, it would probably be difficult for you to define your quality standard in precise terms. Also, your friends may have different opinions regarding which athletic shoes are of highest quality. The difficulty in defining quality exists regardless of product, and this is true for both manufacturing and service organizations. Think about how difficult it may be to define quality for products such as airline services, child day-care facilities, college classes, or even OM textbooks. Further complicating the issue is that the meaning of quality has changed over time.

Today, there is no single universal definition of quality. Some people view quality as "performance to standards."Others view it as "meeting the customer's needs" or "satisfying the customer." Let's look at some of the more common definitions of quality.

- **Conformance to specifications** measures how well the product or service meets the targets and tolerances determined by its designers. For example, the dimensions of a machine part may be specified by its design

engineers as 3.05 inches. This would mean that the target dimension is 3 inches but the dimensions can vary between 2.95 and 3.05 inches. Similarly, the wait for hotel room service may be specified as 20 minutes, but there may be an acceptabledelay of an additional 10 minutes. Also, consider the amount of light delivered by a 60 watt light bulb. If the bulb delivers 50 watts it does not conform to specifications. As these examples illustrate, conformance to specification is directly measurable, though it may not be directly related to the consumer's idea of quality.

- **Fitness for use** focuses on how well the product performs its intended function or use. For example, a Mercedes Benz and a Jeep Cherokee both meet a fitness for use definition if one considers transportation as the intended function. However, if the definition becomes more specific and assumes that the intended use is for transportation on mountain roads and carrying fishing gear, the Jeep Cherokee has a greater fitness for use. You can also see that fitness for use is a user-based definition in that it is intended to meet the needs of a specific user group.
- **Value for price paid** is a definition of quality that consumers often use for product or service usefulness. This is the only definition that combines economics with consumer criteria; it assumes that the definition of quality is price sensitive. For example, suppose that you wish to sign up for a personal finance seminar and discover that the same class is being taught at two different colleges at significantly different tuition rates. If you take the less expensive seminar, you will feel that you have received greater value for the price.
- **Support services** provided are often how the quality of a product or service is judged. Quality does not apply only to the product or service itself; it also applies to the people, processes, and organizational environment associated with it. For example, the quality of a university is judged not only by the quality of staff and course offerings, but also by the efficiency and accuracy of processing paperwork.
- **Psychological criteria** is a subjective definition that focuses on the judgmental evaluation of what constitutes product or service quality. Different factors contribute to the evaluation, such as the tmosphere of the environment or the perceived prestige of the product. For example, a hospital patient may receive average health care, but a very friendly staff may leave the impression of high quality. Similarly, we commonly associate certain products with excellence because of their reputation; Rolex watches and Mercedes-Benz automobiles are examples.

DIFFERENCES BETWEEN MANUFACTURING AND SERVICE ORGANIZATIONS

Defining quality in manufacturing organizations is often different from that of services. Manufacturing organizations produce a tangible product that can be seen, touched, and directly measured. Examples include cars, CD players, clothes, computers, and food items. Therefore, quality definitions in manufacturing usually focus on tangible product features.

The most common quality definition in manufacturing is conformance, which is the degree to which a product characteristic meets preset standards. Other common definitions of quality in manufacturing include performance—such as acceleration of a vehicle; reliability—that the product will function as expected without failure; features—the extras that are included beyond the basic characteristics; durability— expected operational life of the product; and serviceability—how readily a product can be repaired. The relative importance of these definitions is based on the preferences of each individual customer. It is easy to see how different customers can have different definitions in mind when they speak of high product quality.

In contrast to manufacturing, service organizations produce a product that is intangible. Usually, the complete product cannot be seen or touched. Rather, it is experienced. Examples include delivery of health care, experience of staying at a vacation resort, and learning at a university. The intangible nature of the product makes defining quality difficult. Also, since a service is experienced, perceptions can be highly subjective. In addition to tangible factors, quality of services is often defined by perceptual factors. These include responsiveness to customer needs, courtesy and friendliness of staff, promptness in resolving complaints, and atmosphere. Other definitions of quality in services include time—the amount of time a customer has to wait for the service; and consistency—the degree to which the service is the same each time. For these reasons, defining quality in services can be specially challenging. Dimensions of quality for manufacturing versus service organizations are shown in Table – 1.

Table 1 : Dimensions of Quality for Manufacturing Versus Service Organizations

Manufacturing Organizations	Service Organizations
Conformance to specifications	Tangible factors
Performance	Consistency

Reliability	Responsiveness to customer needs
Features	Courtesy/friendliness
Durability	Timeliness/promptness
Serviceability	Atmosphere

COST OF QUALITY

The reason quality has gained such prominence is that organizations have gained an understanding of the high cost of poor quality. Quality affects all aspects of the organization and has dramatic cost implications. The most obvious consequence occurs when poor quality creates dissatisfied customers and eventually leads to loss of business.

However, quality has many other costs, which can be divided into two categories. The first category consists of costs necessary for achieving high quality, which are called quality control costs. These are of two types: prevention costs and appraisal costs. The second category consists of the cost consequences of poor quality, which are called quality failure costs. These include external failure costs and internal failure costs. These costs of quality are shown in Figure 1. The first two costs are incurred in the hope of preventing the second two.

Prevention costs are all costs incurred in the process of preventing poor quality from occurring. They include quality planning costs, such as the costs of developing and implementing a quality plan. Also included are the costs of product and process design, from collecting customer information to designing processes that achieve conformance to specifications. Employee training in quality measurement is included as part of this cost, as well as the costs of maintaining records of information and data related to quality.

Appraisal costs are incurred in the process of uncovering defects. They include the cost of quality inspections, product testing, and performing audits to make sure that quality standards are being met. Also included in this category are the costs of worker time spent measuring quality and the cost of equipment used for quality appraisal.

Internal failure costs are associated with discovering poor product quality before the product reaches the customer site. One type of internal failure cost is rework, which is the cost of correcting the defective item. Sometimes the item is so defective that it cannot be corrected and must be thrown away. This is called scrap, and its costs include

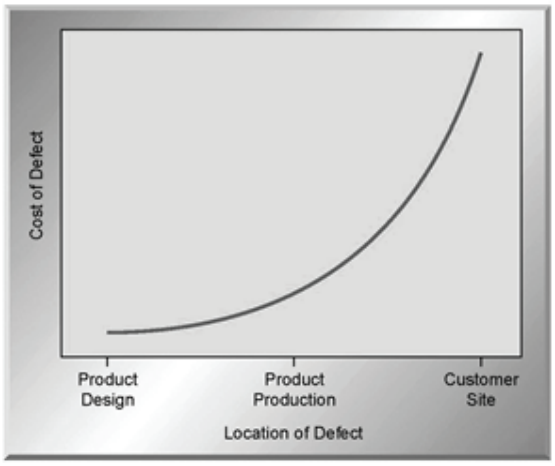
Table 1 : Costs of quality

Prevention costs.	Costs of preparing and implementing a quality plan.
Appraisal costs.	Costs of testing, evaluating, and inspecting quality.
Internal failure costs.	Costs of scrap, rework, and material losses.
External failure costs.	Costs of failure at customer site, including returns, repairs, and recalls.

all the material, labor, and machine cost spent in producing the defective product. Other types of internal failure costs include the cost of machine downtime due to failures in the process and the costs of discounting defective items for salvage value.

External failure costs are associated with quality problems that occur at the customer site. These costs can be particularly damaging because customer faith and loyalty can be difficult to regain. They include everything from customer complaints, product returns, and repairs, to warranty claims, recalls, and even litigation costs resulting from product liability issues. A final component of this cost is lost sales and lost customers. For example, manufacturers of lunch meats and hot dogs whose products have been recalled due to bacterial contamination have had to struggle to regain consumer confidence. Other examples include auto manufacturers whose products have been recalled due to major malfunctions such as problematic braking systems and airlines that have experienced a crash with many fatalities. External failure can sometimes put a company out of business almost overnight. Companies that consider quality important invest heavily in prevention and appraisal costs in order to prevent internal and external failure costs. The earlier defects are found, the less costly they are to correct. For example, detecting and correcting defects during product design and product production is considerably less expensive than when the defects are found at the customer site. This is shown in Figure

Figure 2 : Cost of Defects



External failure costs tend to be particularly high for service organizations. The reason is that with a service the customer spends much time in the service delivery system, and there are fewer pportunities to correct defects than there are in manufacturing. Examples of external failure in services include an airline that has overbooked flights, long delays in airline service, and lost luggage.

The Evolution of Total Quality Management (TQM)

The concept of quality has existed for many years, though its meaning has changed and evolved over time. In the early twentieth century, quality management meant inspecting products to ensure that hey met specifications. In the 1940s, during World War II, quality became more statistical in nature. Statistical sampling techniques were used to evaluate quality, and quality control charts were used to monitor the production process. In the 1960s, with the help of so-called "quality gurus," the concept took on a broader meaning. Quality began to be viewed as something that encompassed the entire organization, not only the production process. Since all functions were responsible for product quality and all shared the costs of poor quality, quality was seen as a concept that affected the entire organization. The meaning of quality for businesses changed dramatically in the late 1970s. Before then quality was still viewed as something that needed to be inspected and corrected. However, in the 1970s and 1980s many U.S. industries lost market share to foreign competition. In the auto industry, manufacturers such as Toyota and Honda became major players. In the consumer goods market, companies such as Toshiba and Sony led the way. These foreign competitors were producing lower-priced products with considerably higher quality.

To survive, companies had to make major changes in their quality programs. Many hired consultants and instituted quality training programs for their employees. A new concept of quality was emerging.

One result is that quality began to have a strategic meaning. Today, successful companies understand that quality provides a competitive advantage. They put the customer first and define quality as meeting or exceeding customer expectations.

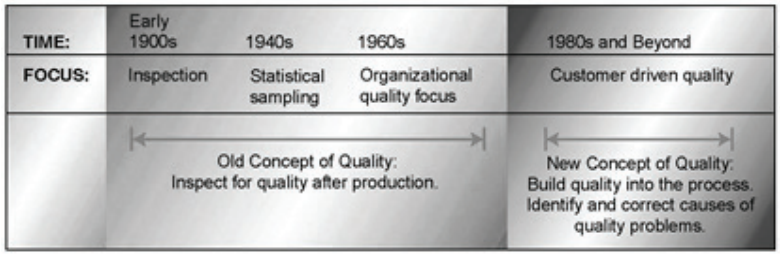
Since the 1970s, competition based on quality has grown in importance and has generated tremendous interest, concern, and enthusiasm. Companies in every line of business are focusing on improving quality in order to be more competitive. In many industries quality excellence has become a standard for doing business. Companies that do not meet this standard simply will not survive. As you will see later in the chapter, the importance of quality is demonstrated by national quality awards and

quality certifications that are coveted by businesses. The term used for today's new concept of quality is total quality management or TQM. Figure 3 presents a timeline of the old and new concepts of quality. You can see that the old concept is reactive, designed to correct quality problems after they occur. The new concept is proactive, designed to build quality into the product and process design. Next, we look at the individuals who have shaped our understanding of quality.

Quality Gurus

To fully understand the TQM movement, we need to look at the philosophies of notable individuals who have shaped the evolution of TQM. Their philosophies and teachings have contributed to our knowledge and understanding of quality today. Their individual contributions are summarized in Table 2.

FIGURE 3 : Timeline showing the differences between old and new concepts of quality



Walter A. Shewhart Walter A. Shewhart was a statistician at Bell Labs during the 1920s and 1930s. Shewhart studied randomness and recognized that variability existed in all manufacturing processes. He developed quality control charts that are used to identify whether the variability in the process is random or due to an assignable cause, such as poor workers or miscalibrated machinery. He stressed that eliminating variability improves quality. His work created the foundation for today's statistical process control, and he is often referred to as the "grandfather of quality control."

W. Edwards Deming W. Edwards Deming is often referred to as the "father of quality control." He was a statistics professor at New York University in the 1940s. After World War II he assisted many Japanese companies in improving quality. The Japanese regarded him so highly that in 1951 they established the Deming Prize, an annual award given to firms that demonstrate outstanding quality. It was almost 30 years later that American businesses began adopting Deming's philosophy. A number of elements of Deming's philosophy depart from traditional notions of quality. The first is the role management should play in a company's quality.

TABLE 2 : Quality Gurus and Their Contributions

Quality Guru	Main Contribution
Walter A. Shewhart	– Contributed to understanding of process variability. – Developed concept of statistical control charts.
W. Edwards Deming	– Stressed management's responsibility for quality. – Developed "14 Points" to guide companies in quality improvement.
Joseph M. Juran	– Defined quality as "fitness for use." – Developed concept of cost of quality.
Armand V. Feigenbaum	– Introduced concept of total quality control.
Philip B. Crosby	– Coined phrase "quality is free." – Introduced concept of zero defects.
Kaoru Ishikawa	– Developed cause-and-effect diagrams. – Identified concept of "internal customer."
Genichi Taguchi	– Focused on product design quality. – Developed Taguchi loss function.

improvement effort. Historically, poor quality was blamed on workers—on their lack of productivity, laziness, or carelessness. However, Deming pointed out that only 15 percent of quality problems are actually due to worker error. The remaining 85 percent are caused by processes and systems, including poor management.

Deming said that it is up to management to correct system problems and create an environment that promotes quality and enables workers to achieve their full potential. He believed that managers should drive out any fear employees have of identifying quality problems, and that numerical quotas should be eliminated. Proper methods should be taught, and detecting and eliminating poor quality should be everyone's responsibility.

Deming outlined his philosophy on quality in his famous "14 Points." These points are principles that help guide companies in achieving quality improvement. The principles are founded on the idea that upper management must develop a commitment to quality and provide a system to support this commitment that involves all employees and suppliers. Deming stressed that quality improvements cannot happen without organizational change that comes from upper management.

Joseph M. Juran After W. Edwards Deming, Dr. Joseph Juran is considered to have had the greatest impact on quality management. Juran originally worked in the quality program at Western Electric. He became better known in 1951, after the publication of his book Quality Control Handbook. In 1954 he went to Japan to work with manufacturers and teach classes on quality. Though his philosophy is similar to Deming's, there are some differences. Whereas Deming stressed the need for an organizational "transformation," Juran believes that

implementing quality initiatives should not require such a dramatic change and that quality management should be embedded in the organization. One of Juran's significant contributions is his focus on the definition of quality and the cost of quality. Juran is credited with defining quality as fitness for use rather than simply conformance to specifications. As we have learned in this chapter, defining quality as fitness for use takes into account customer intentions for use of the product, instead of only focusing on technical specifications. Juran is also credited with developing the concept of cost of quality, which allows us to measure quality in dollar terms rather than on the basis of subjective evaluations. Juran is well known for originating the idea of the quality trilogy: quality planning, quality control, and quality improvement. The first part of the trilogy, quality planning, is necessary so that companies identify their customers, product requirements, and overriding business goals. Processes should be set up to ensure that the quality standards can be met. The second part of the trilogy, quality control, stresses the regular use of statistical control methods to ensure that quality standards are met and to identify variations from the standards. The third part of the quality trilogy is quality improvement. According to Juran, quality improvements should be continuous as well as breakthrough. Together with Deming, Juran stressed that to implement continuous improvement workers need to have training in proper methods on a regular basis.

Armand V. Feigenbaum Another quality leader is Armand V. Feigenbaum, who introduced the concept of total quality control. In his 1961 book Total Quality Control, he outlined his quality principles in 40 steps. Feigenbaum took a total system approach to quality. He promoted the idea of a work environment where quality devel opments are integrated throughout the entire organization, where management and employees have a total commitment to improve quality, and people learn from each other's successes. This philosophy was adapted by the Japanese and termed "company-wide quality control."

Phillip B. Crosby Philip B. Crosby is another recognized guru in the area of TQM. He worked in the area of quality for many years, first at Martin Marietta and then, in the 1970s, as the vice president for quality at ITT. He developed the phrase "Do it right the first time" and the notion of zero defects, arguing that no amount of defects should be considered acceptable. He scorned the idea that a small number of defects is a normal part of the operating process because systems and workers are imperfect. Instead, he stressed the idea of prevention. To promote his concepts, Crosby wrote a book titled Quality Is Free, which was published in 1979. He became famous for coining the phrase "quality is free" and for pointing out the many costs of quality, which include not only the costs of wasted labor, equipment time, scrap, rework, and lost sales, but also organizational costs that are hard to quantify. Crosby stressed that efforts to improve quality more than pay for themselves because these costs are prevented. Therefore, quality is free. Like Deming and Juran, Crosby stressed the role of management in the quality improvement effort and the use of statistical control tools in measuring and monitoring quality.

Kaoru Ishikawa **Kaoru Ishikawa** is best known for the development of quality tools called cause-and-effect diagrams, also called fishbone or Ishikawa diagrams. These diagrams are used for quality problem solving, and we will look at them in detail later in the chapter. He was the first quality guru to emphasize the importance of the "internal customer," the next person in the production process. He was also one of the first to stress the importance of total company quality control, rather than just focusing on products and services. Dr. Ishikawa believed that everyone in the company needed to be united with a shared vision and a common goal. He stressed that quality initiatives should be pursued at every level of the organization and that all employees should be involved. Dr. Ishikawa was a proponent of implementation of quality circles, which are small teams of employees that volunteer to solve quality problems.

Genichi Taguchi Dr. **Genichi Taguchi** is a Japanese quality expert known for his work in the area of product design. He estimates that as much as 80 percent of all defective items are caused by poor product design. Taguchi stresses that companies should focus their quality efforts on the design stage, as it is much cheaper and easier to make changes during the product design stage than later during the production process. Taguchi is known for applying a concept called design of experiment to product design. This method is an engineering approach that is based on developing robust design, a design that results in products that can perform over a wide range of conditions. Taguchi's philosophy is based on the idea that it is easier to design a productthat can perform over a wide range of environmental conditions than it is to control the environmental conditions. Taguchi has also had a large impact on today's view of the costs of quality. He pointed out that the traditional view of costs of conformance to specifications is incorrect, and proposed a different way to look at these costs. Let's briefly look at Dr. Taguchi's view of quality costs.

Recall that conformance to specification specifies a target value for the product with specified tolerances, say 5.00 _ 0.20. According to the traditional view of conformance to specifications, losses in terms of cost occur if the product dimensions fall outside of the specified limits. This is shown in Figure 4. However, Dr. Taguchi noted that from the customer's view there is little difference whether a product falls just outside or just inside the control limits. He pointed out that there is a much greater difference in the quality of the product between making the target and being near the control limit. He also stated that the smaller the variation around the target, the better

the quality. Based on this he proposed the following: as conformance values move away from the target, loss increases as a quadratic function. This is called the Taguchi loss function and is shown in Figure 5-5. According to the function, smaller differences from the target result in smaller costs: the larger the differences, the larger the cost. The Taguchi loss function has had a significant impact in changing the view of quality cost.

FIGURE 4 : Traditional view of the cost of non-conformance

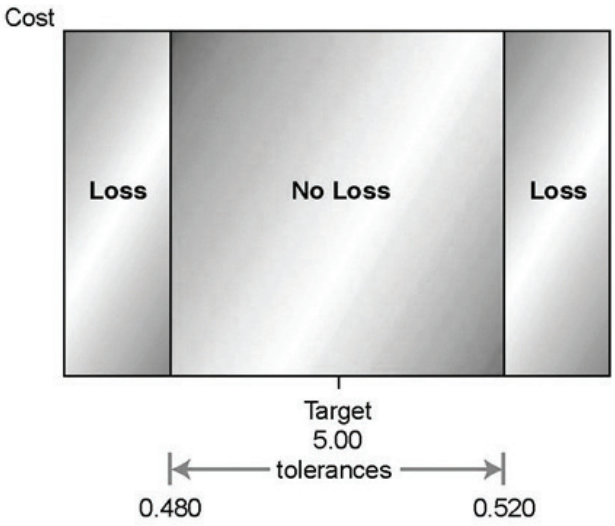
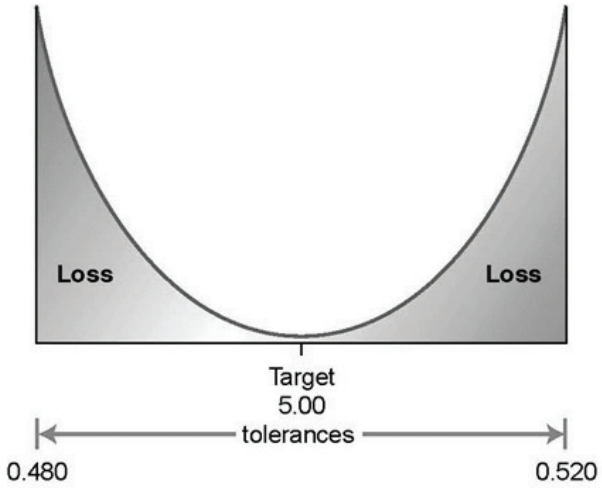


FIGURE 5: Taguchi view of the cost of non-conformance—the Taguchi loss function



What characterizes TQM is the focus on identifying root causes of quality problems and correcting them at the source, as opposed to inspecting the product after it has been made. Not only does TQM encompass the entire organization, but it stresses that quality is customer driven. TQM attempts to embed quality in every aspect of the organization. It is concerned with technical aspects of quality as well as the involvement of people in quality, such as customers, company employees, and suppliers. Here we look at the specific concepts that make up the philosophy of TQM. These concepts and their main ideas are summarized in Table 5-3.

Customer Focus

The first, and overriding, feature of TQM is the company's focus on its customers. Quality is defined as meeting or exceeding customer expectations. The goal is to first identify and then meet customer needs. TQM recognizes that a perfectly produced product has little value if it is not what the customer wants. Therefore, we can say that quality is customer driven. However, it is not always easy to determine what the customer wants, because tastes and preferences change. Also, customer expectations often vary from one customer to the next. For example, in the auto industry trends change relatively quickly, from small cars to sports utility vehicles and back

to small cars. The same is true in the retail industry, where styles and fashion are short lived. Companies need to continually gather information by means of focus groups, market surveys, and customer interviews in order to stay in tune with what customers want. They must always remember that they would not be in business if it were not for their customers.

Continuous Improvement

Another concept of the TQM philosophy is the focus on continuous improvement. Traditional systems operated on the assumption that once a company achieved a certain level of quality, it was successful and needed no further improvements. We tend to think of improvement in terms of plateaus that are to be achieved, such as passing a certification test or reducing the number of defects to a certain level.

Traditionally, change for American managers involves large magnitudes, such as major organizational restructuring. The Japanese, on the other hand, believe that the best and most lasting changes come from gradual improvements. To use an analogy, they believe that it is better to take frequent small doses of medicine than to take one large dose. Continuous improvement, called kaizen by the Japanese, requires that the company continually strive to be better through learning and problem

solving. Because we can never achieve perfection, we must always evaluate our performance and take measures to improve it. Now let's look at two approaches that can help companies with continuous improvement: the plan –do– study – act (PDSA) cycle and benchmarking.

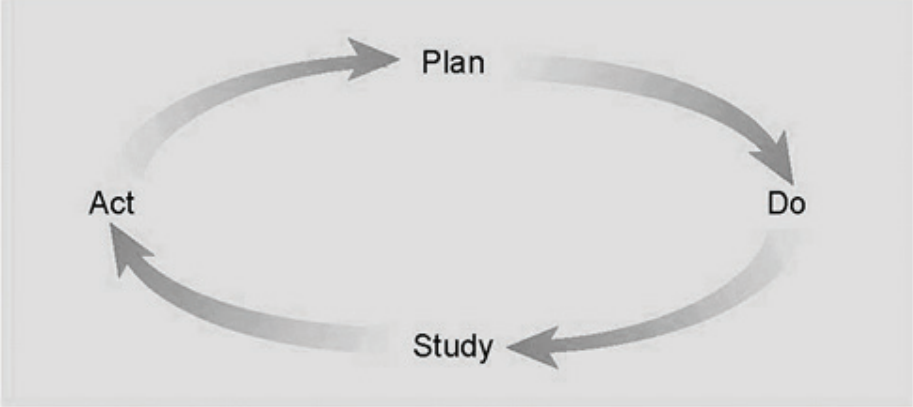
TABLE : Concepts of the TQM Philosophy

Concept	Main Idea
Customer focus	Goal is to identify and meet customer needs.
Continuous improvement	A philosophy of never-ending improvement.
Employee empowerment	Employees are expected to seek out, identify, and correct quality problems.
Use of quality tools	Ongoing employee training in the use of quality tools.
Product design	Products need to be designed to meet customer expectations.
Process management	Quality should be built into the process; sources of quality problems should be identified and corrected.
Managing supplier quality	Quality concepts must extend to a company's suppliers.

The Plan–Do–Study–Act Cycle The plan–do–study–act (PDSA) cycle describes the activities a company needs to perform in order to incorporate continuous improvement in its operation. This cycle, shown in Figure 5-6 is also referred to as the Shewhart cycle or the Deming wheel. The circular nature of this cycle shows that continuous improvement is a never-ending process. Let's look at the specific steps in the cycle.

- Plan The first step in the PDSA cycle is to plan. Managers must evaluate the current process and make plans based on any problems they find. They need to document all current procedures, collect data, and identify problems. This information should then be studied and used to develop a plan for improvement as well as specific measures to evaluate performance.
- Do The next step in the cycle is implementing the plan (do). During the implementation process managers should document all changes made and collect data for evaluation.
- Study The third step is to study the data collected in the previous phase. The data are evaluated to see whether the plan is achieving the goals established in the plan phase.
- Act The last phase of the cycle is to act on the basis of the results of the first three phases. The best way to accomplish this is to communicate the results to other members in the company and then implement the new procedure if it has been successful. Note that this is a cycle; the next step is to plan again. After we have acted, we need to continue evaluating the process, planning, and repeating the cycle again.

FIGURE 6 : The plan–do–study–act cycle



Benchmarking Another way companies implement continuous improvement is by studying business practices of companies considered "best in class." This is called benchmarking. The ability to learn and study how others do things is an important part of continuous improvement. The benchmark company does not have to be in the same business, as long as it excels at something that the company doing the study wishes to emulate. For example, many companies have used Lands' End to benchmark catalog distribution and order filling, because Lands' End is considered a leader in this area. Similarly, many companies have used American Express to benchmark conflict resolution.

Employee Empowerment

Part of the TQM philosophy is to empower all employees to seek out quality problems and correct them. With the old concept of quality, employees were afraid to identify problems for fear that they would be reprimanded. Often poor quality was passed on to someone else, in order to make it "someone else's problem." The new concept of quality, TQM, provides incentives for employees to identify quality problems. Employees are rewarded for uncovering quality problems, not punished.

In TQM, the role of employees is very different from what it was in traditional systems. Workers are empowered to make decisions relative to quality in the production process. They are considered a vital element of the effort to achieve high quality. Their contributions are highly valued, and their suggestions are implemented. In order to perform this function, employees are given continual and extensive training in quality measurement tools.

To further stress the role of employees in quality, TQM differentiates between external and internal customers. External customers are those that purchase the company's goods and services. Internal customers are employees of the organization who receive goods or services from others in the company. For example, the packaging department of an organization is an internal customer of the assembly department. Just as a defective item would not be passed to an external customer, a defective item should not be passed to an internal customer.

Team Approach TQM stresses that quality is an organizational effort. To facilitate the solving of quality problems, it places great emphasis on teamwork. The use of teams is based on the old adage that "two heads are better than one."Using techniques such as brainstorming, discussion, and quality control tools, teams work regularly to correct problems. The contributions of teams are considered vital to the success of the company. For this reason, companies set aside time in the workday for team meetings.

Teams vary in their degree of structure and formality, and different types of teams solve different types of problems. One of the most common types of teams is the quality circle, a team of volunteer production employees and their supervisors whose purpose is to solve quality problems. The circle is usually composed of eight to ten members, and decisions are made through group consensus. The teams usually meet weekly during work hours in a place designated for this purpose. They follow a preset process for analyzing and solving quality problems. Open discussion is promoted, and criticism is not allowed. Although the functioning of quality circles is friendly and casual, it is serious business. Quality circles are not mere "gab sessions." Rather, they do important work for the company and have been very successful in many firms.

The importance of exceptional quality is demonstrated by The Walt Disney Company in operating its theme parks. The focus of the parks is customer satisfaction. This is accomplished through meticulous attention to every detail, with particular focus on the role of employees in service delivery. Employees are viewed as the most

important organizational resource and great care is taken in employee hiring and training. All employees are called "cast members," regardless of whether they are janitors or performers. Employees are extensively trained in customer service, communication, and quality awareness. Continual monitoring of quality is considered important, and employees meet regularly in teams to evaluate their effectiveness. All employees are shown how the quality of their individual jobs contributes to the success of the park.

Use of Quality Tools

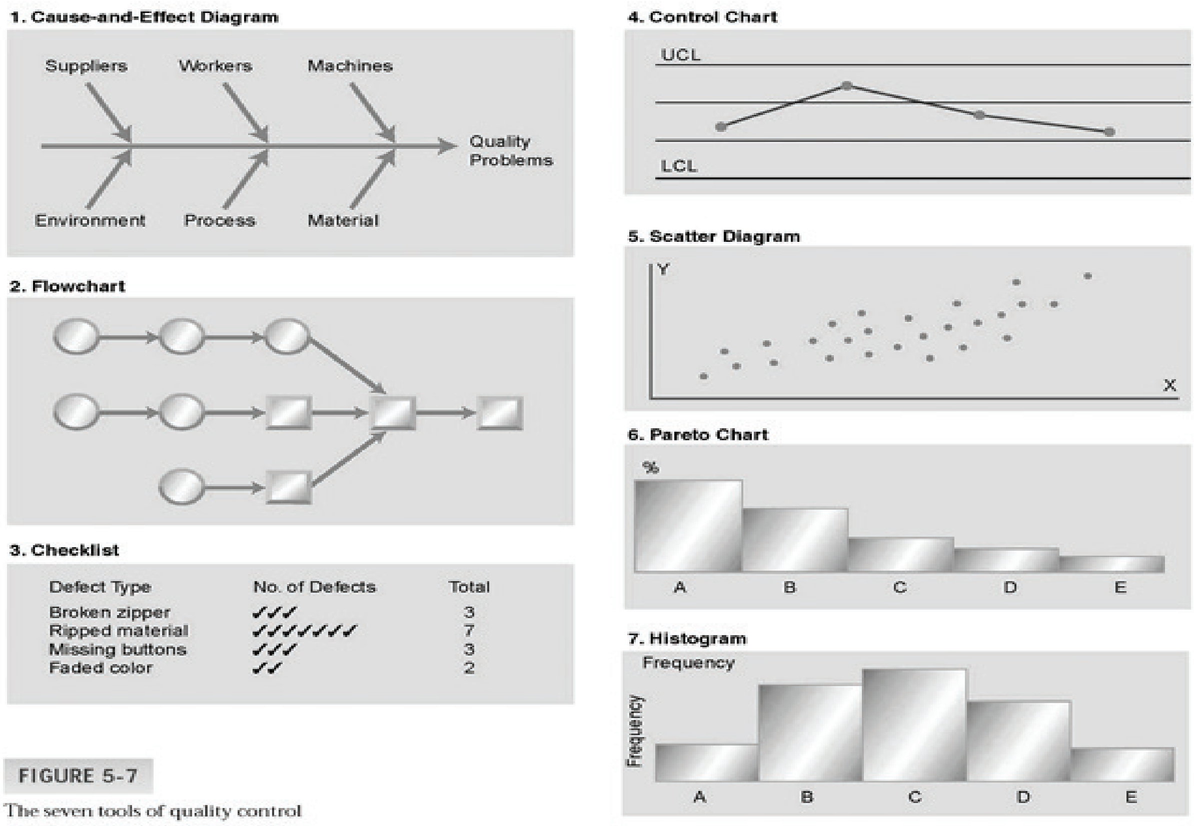
You can see that TQM places a great deal of responsibility on all workers. If employees are to identify and correct quality problems, they need proper training. They need to understand how to assess uality by using a variety of quality control tools, how to interpret findings, and how to correct problems. In this section we look at seven different quality tools. These are often called the seven tools of quality control and are shown in Figure 7. They are easy to understand, yet extremely useful in identifying and analyzing quality problems. Sometimes workers use only one tool at a time, but often a combination of tools is most helpful.

Cause-and-Effect Diagrams Cause-and-effect diagrams are charts that identify potential causes for particular quality problems. They are often called fishbone diagrams because they look like the bones of a fish. A general cause-and-effect diagram is shown in Figure 8. The "head" of the fish is the quality problem, such as damaged zippers on a garment or broken valves on a tire. The diagram is drawn so that the "spine" of the fish connects the "head" to the possible cause of the problem. These causes could be related to the machines, workers, measurement, suppliers, materials, and many other aspects of the production process. Each of these possible causes can then have smaller "bones" that address specific issues that relate to each cause. For example, a problem with machines could be due to a need for adjustment, old equipment, or tooling problems. Similarly, a problem with workers could be related to lack of training, poor supervision, or fatigue.

Cause-and-effect diagrams are problem-solving tools commonly used by quality control teams. Specific causes of problems can be explored through brainstorming. The development of a cause- and-effect diagram requires the team to think through all the possible causes of poor quality.

Flowcharts A flowchart is a schematic diagram of the sequence of steps involved in an operation or process. It provides a visual tool that is easy to use and understand. By seeing the steps involved in an operation or process, everyone develops a clear picture of how the operation works and where problems could arise.

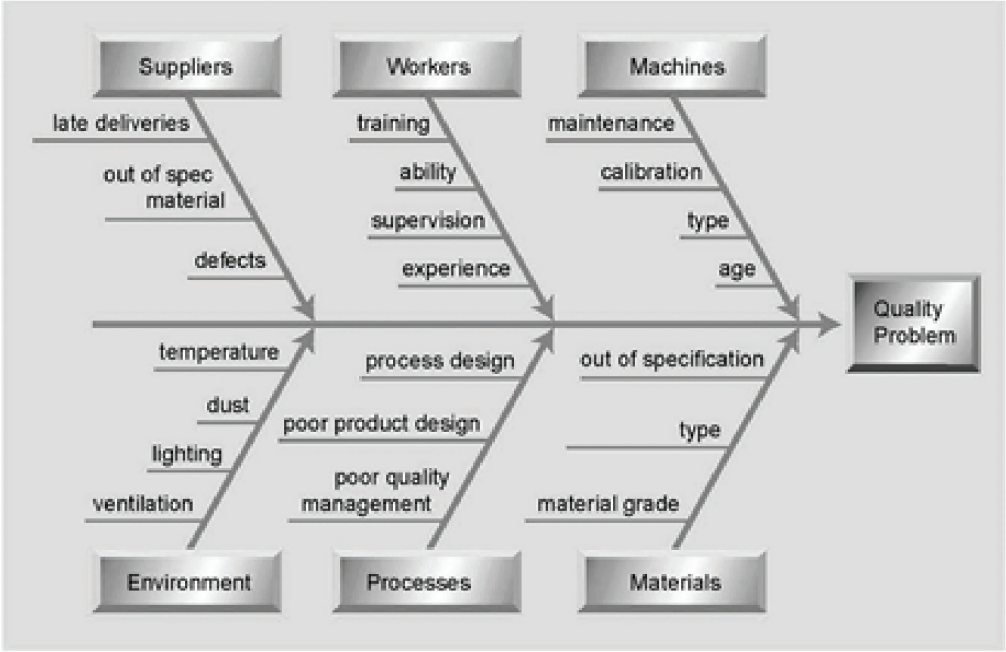
FIGURE 7 : The seven tools of quality control



Checklists A checklist is a list of common defects and the number of observed occurrences of these defects. It is a simple yet effective fact-finding tool that allows the worker to collect specific information regarding the defects observed. The checklist in Figure 5-7 shows four defects and the number of times they have been observed. It is clear that the biggest problem is ripped material. This means that the plant needs to focus on this specific problem—for example, by going to the source of supply or seeing whether the material rips during a

particular production process. A checklist can also be used to focus on other dimensions, such as location or time. For example, if a defect is being observed frequently, a checklist can be developed that measures the number of occurrences per shift, per machine, or per operator. In this fashion we can isolate the location of the particular defect and then focus on correcting the problem.

FIGURE 8 : A general cause-and-effect (fishbone) diagram



Control Charts Control charts are a very important quality control tool. We will study the use of control charts at great length in the next chapter. These charts are used to evaluate whether a process is operating within expectations relative to some measured value such as weight, width, or volume. For example, we could measure the weight of a sack of flour, the width of a tire, or the volume of a bottle of soft drink.When the production process is operating within expectations, we say that it is "in control."

To evaluate whether or not a process is in control, we regularly measure the variable of interest and plot it on a control chart. The chart has a line down the center representing the average value of the variable we are measuring. Above and below the center line are two lines, called the upper control limit (UCL) and the lower control limit (LCL). As long as the observed values fall within the upper and lower control limits, the process is in control and there is no problem with quality. When a measured observation falls outside of these limits, there is a problem.

Scatter Diagrams Scatter diagrams are graphs that show how two variables are related to one another. They are particularly useful in detecting the amount of correlation, or the degree of linear relationship, between two variables. For example, increased production speed and number of defects could be correlated positively; as production speed increases, so does the number of defects. Two variables could also be correlated negatively, so that an increase in one of the variables is associated with a decrease in the other. For example, increased worker training might be associated with a decrease in the number of defects observed. The greater the degree of correlation, the more linear are the observations in the scatter diagram. On the other hand, the more scattered the observations in the diagram, the less correlation exists between the variables. Of course, other types of relationships can also be observed on a scatter diagram, such as an inverted _. This may be the case when one is observing the relationship between two variables such as oven temperature and number of defects, since temperatures below and above the ideal could lead to defects.

Pareto Analysis Pareto analysis is a technique used to identify quality problems based on their degree of importance. The logic behind Pareto analysis is that only a few quality problems are important, whereas many others are not critical. The technique was named after Vilfredo Pareto, a nineteenth-century Italian economist who determined that only a small percentage of people controlled most of the wealth.

This concept has often been called the 80–20 rule and has been extended to many areas. In quality management the logic behind Pareto's principle is that most quality problems are a result of only a few causes. The trick is to

identify these causes. One way to use Pareto analysis is to develop a chart that ranks the causes of poor quality in decreasing order based on the percentage of defects each has caused. For example, a tally can be made of the number of defects that result from different causes, such as operator error, defective parts, or inaccurate machine calibrations. Percentages of defects can be computed from the tally and placed in a chart like those shown in Figure 5-7.We generally tend to find that a few causes account for most of the defects.

Histograms A histogram is a chart that shows the frequency distribution of observed values of a variable.We can see from the plot what type of distribution a particular variable displays, such as whether it has a normal distribution and whether the distribution is symmetrical.

In the food service industry the use of quality control tools is important in identifying quality problems. Grocery store chains, such as Kroger and Meijer, must record and monitor the quality of incoming produce, such as tomatoes and lettuce. Quality tools can be used to evaluate the acceptability of product quality and to monitor product quality from individual suppliers. They can also be used to evaluate causes of quality problems, such as long transit time or poor refrigeration. Similarly, restaurants use quality control tools to evaluate and monitor the quality of delivered goods, such as meats, produce, or baked goods.

Product Design

Quality Function Deployment A critical aspect of building quality into a product is to ensure that the product design meets customer expectations. This typically is not as easy as it seems. Customers often speak in everyday language. For example, a product can be described as "attractive," "strong," or "safe." However, these terms can have very different meaning to different customers. What one person considers to be strong, another may not. To produce a product that customers want, we need to translate customers' everyday language into specific technical requirements. However, this can often be difficult. A useful tool for translating the voice of the customer into specific technical requirements is quality function deployment (QFD). Quality function deployment is also useful in enhancing communication between different functions, such as marketing, operations, and engineering. QFD enables us to view the relationships among the variables involved in the design of a product, such as technical versus customer requirements. This can help us analyze the big picture—for example, by running tests to see how changes in certain technical requirements of the product affect customer requirements. An example is an automobile manufacturer evaluating how changes in materials affect customer safety requirements. This type of analysis can be very beneficial in developing a product design that meets customer needs, yet does not create unnecessary technical requirements for production. QFD begins by identifying important customer requirements, which typically come from the marketing department. These requirements are numerically scored based on their importance, and scores are translated into specific product characteristics. Evaluations are then made of how the product compares with its main competitors relative to the identified characteristics. Finally, specific goals are set to address the identified problems. The resulting matrix looks like a picture of a house and is often called the house of quality.

To summarize the above discussion it can be said that TQM is a philosophy of continuously improving the quality of all the products and processes in response to continuous feedback for meeting the customers' requirements. It aims to do things right the frst time, rather than need to fix problems after they emerge (A company should avoid defects rather than correct them). Its basic objective is customer satisfaction.

The elements of TQM are:

Total	Quality involves everyone and all activities in the company (Mobilizing the whole organization to achieve quality continuously and economically)
Quality	Understanding and meeting the customers' requirements. (Satisfying the customers first time every time)
Management	Quality can and must be managed (Avoid defects rather than correct them)

TQM is a vision based, customer focused, prevention oriented, continuously improvement strategy based on scientific approach adopted by cost conscious people committed to satisfy the customers first time every time. It aims at Managing an organization so that it excels in areas important to the customer. Some authors have elaborated the principles as ten (10) points instead of the eight (8) discussed above. These are in tandem with the discussion already undertaken. Even then the principles are mentioned below;

- The underlying principles of TQM;

  The philosophy of TQM rest on the following principles which are enlisted below:

1. Clear exposition of the benefits of a project.
2. Total Employee involvement (TEI).

3. Process measurement.
4. Involvement of all customers and contributors.
5. Elimination of irrelevant data.
6. Understanding the needs of the whole process.
7. Use of graphical and pictorial techniques to achieve understanding.
8. Establishment of performance specifications and targets.
9. Use of errors to prompt continuous improvement.
10. Use of statistics to tell people how well they are doing

Now, we endeavor to analyze the steps required for successful implementation of TQM in an organization.

• Steps in Total Quality Management:

Step 1: Identification of customers/customer groups:

Through a team approach (a technique called Multi-Voting), the Firm should identify major customer groups. This helps in generating priorities in the identification of customers and critical issues in the provision of decision-support information.

Step 2: Identifying customer expectations:

Once the major customer groups are identified, their expectations are listed. The question to be answered is - What does the customer expect from the Firm?

Step 3: Identifying customer decision-making requirements and product utilities:

By identifying the need to stay close to the customers and follow their suggestions, a decision support system can be developed, incorporating both financial and non-financial and non-financial information, which seeks to satisfy user requirements. Hence, the Firm finds out the answer to – What are the customer's decision-making requirements and product utilities? The answer is sought by listing out managerial perceptions and not by actual interaction with the customers.

Step 4: Identifying perceived problems in decision-making process and product utilities:

Using participative processes such as brainstorming and multi-voting, the Firm seeks to list out its perception of problem areas and shortcomings in meeting customer requirements. This will list out areas of weakness where the greatest impact could be achieved through the implementation of improvements. The Firm identifies the answer to the question - What problem areas do we perceive in the decision-making process?

Step 5: Comparison with other Firms and benchmarking:

Detailed and systematic internal deliberations allow the Firm to develop a clear idea of their own strengths and weaknesses and of the areas of most significant deficiency. Benchmarking exercise allows the Firm to see how other Companies are coping with similar problems and opportunities.

Step 6: Customer Feedback:

Steps 1 to 5 provide a information base developed without reference to the customer. This is rectified at Steps 6 with a survey of representative customers, which embraces their views on perceived problem areas. Interaction with the customers and obtaining their views helps the Firm in correcting its own perceptions and refining its processes.

Steps 7 & 8: Identification of improvement opportunities and implementation of Quality Improvement Process:

The outcomes of the customer survey, benchmarking and internal analysis, provides the inputs for Steps 7 and 8, i.e. the identification of improvement opportunities and the implementation of a formal improvement process. This is done through a six-step process called PRAISE, for short. 6C's and 4P's

The essential requirements for successful implementation are described as the six C's of TQM. These are:

The 6C's	
Commitment	If a TQM culture is to be developed, total commitment must come from top management. It is not sufficient to delegate 'quality' issues to a single person. Quality expectations must be made clear by the top management, together with the support and training required for its achievement.
Culture	Training lies at the centre of effecting a change in culture and attitudes. Negative perceptions must be changed to encourage individual contributions and to make 'quality' a normal part of everyone's job.

Continuous improvement	TQM should be recognised as a 'continuous process'. It is not a 'one-time programme'. There will always be room for improvement, however small it may be.
Co-operation	TQM visualises Total Employee Involvement (TEI). Employee involvement and co-operation should be sought in the development of improvement strategies and associated performance measures.
Customer focus	The needs of external customers (in receipt of the final product or service) and also the internal customers (colleagues who receive and supply goods, services or information), should be the prime focus.
Control	Documentation, procedures and awareness of current best practice are essential if TQM implementations are to function appropriately. Unless control procedures are in place, improvements cannot be monitored and measured nor deficiencies corrected.

It is possible that the organisation is led to Total Quality Paralysis, instead of improvement, by improper implementation of TQM. To avoid such disruption and paralysis the following principles (called the four P's) of TQM should be followed:

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The 4P's	
People	To avoid misdirection, TQM teams should consist of team spirited individuals who have a flair for accepting and meeting challenges. Individuals who are not ideally suited to the participatory process of TQM, should not be involved at all, e.g. lack of enthusiasm, non-attendance at TQM meetings, failure to complete delegated work, remaining a "Mute Spectator" at TQM meetings, etc.
Process	It is essential to approach problem-solving practically and to regard the formal process as a system designed to prevent participants from jumping to conclusions. As such, it will provide a means to facilitate the generation of alternatives while ensuring that important discussion stages are not omitted.
Problem	Problems need to be approached in a systematic manner, with teams tackling solvable problems with a direct economic impact, allowing for immediate feedback together with recognition of the contribution made by individual participants.
Preparation	Additional training on creative thinking and statistical processes are needed in order to give participants a greater appreciation of the diversity of the process. This training must quickly be extended beyond the immediate accounting circle to include employees at supervisory levels and also who are involved at the data input stagey

5 THROUGHPUT ACCOUNTING & THEORY OF CONSTRAINTS

THROUGHPUT COSTING

Throughput Accounting *is a management accounting technique used as a performance measure in the theory of constraints. It is the business intelligence used for maximizing profits. It focuses importance on generating more throughput. It seeks to increase the velocity or speed of production of products and services keeping in view of constraints*. It is based on the concept that a company must determine its overriding goal and then it should create a system that clearly defines the main capacity constraint that allows it to maximize that goal. The changes that this concept causes are startling.

Throughput accounting is a system of performance measurement and costing which traces costs to throughput time. It is claimed that it complements JIT principles and forces attention to the true determinants of profitability. Throughput accounting is defined as follows:

"*A management accounting system which focuses on ways by which the maximum return per unit of bottleneck activity can be achieved*" – CIMA Terminology.

Throughput Concepts:

A few new terms are used in throughput accounting. They are explained as below:

Throughput:

Throughput is the excess of sales value over the totally variable cost. That is nothing but contribution margin left after a product's price is reduced by the amount of its totally variable cost.

Totally Variable Cost:

This cost is incurred only if a product is produced. In many cases only direct materials are considered as totally variable cost. Direct labour is not totally variable, unless piece rate wages are paid.

Capacity Constraints:

It is a resource within a company, that limits its total output. For example, it can be a machine that can produce only a specified amount of a key component in a given time period, thereby keeping overall sales from expanding beyond the maximum capacity of that machine. There may be more than one capacity constraint in a company, but rarely more than one for a specified product or product line.

Throughput (or Cycle) Time:

Throughput (or cycle) time is the average time required to convert raw materials into finished goods ready to be shipped to customer. It includes the time required for activities such as material handling, production processing, inspecting and packaging.

Throughput Efficiency:

Throughput efficiency is the relation of throughput achieved to resources used.

$$\text{Throughput efficiency} = \frac{\text{(Throughput cost)}}{\text{(Actual factory cost)}}$$

Throughput Time Ratio:

It is the ratio of time spent adding customer value to products and services divided by total cycle time. It is also known as the 'ratio of work content to lead time'.

Operating Expenses:

This is sum total of all company expenses including totally variable expenses. It should be noted that throughput accounting does not care, if a cost is semi-variable, fixed or allocated – all costs that are not totally variable is lumped together for throughput accounting purpose. This group of expenses is considered the price that a company pays to ensure that it maintains its current level of capacity.

Investment:

This term is used here also, as it is used in common parlance, i.e. any application of funds, which is intended to provide a return by way of interest, dividend or capital appreciation. However, there is a particular emphasis on company's investment in working capital. This is discussed subsequently in discussion about throughput model.

Throughput Accounting and Contribution Approach:

Throughput accounting has certain similarities with the traditional approach of maximizing contribution per unit of scarce resource. However, there are certain differences. In throughput accounting, return is defined as sales less material costs in contrast to contribution, which is sales less all variable costs, i.e., material, labour, overheads. The assumption (i.e., emphasis) in throughput accounting is that all costs except material are fixed in relation to throughput in short run. Eminent management accountants like Kaplan and Shank have criticized TA for its short-term emphasis. Besides, TA does not appear to be useful in JIT environment. Throughput helps to direct attention to bottlenecks and forces management to concentrate on the key elements in making profits and approach adopted to gain this objective is reduction in inventory and reducing response time to customer demand.

Profitability:

This concept emphasis that profitablility is determined by how quickly goods can be produced to satisfy customer's rder Production for stock does not create profits. Improving the throughput of bottleneck operations will increase the rate at which customer demand cun be met and this will improved profitability. Contribution in its traditional form (sales - variable costs) is not good guide or profitability because it gnores capacity factors and rate of production.

$$\text{Return per factory hour} = \left[\frac{\text{sales Prices - material Cost}}{\text{Time on key resource i.e., the bottleneck}}\right]$$

Product costs are measured thus:

$$\text{Cost per factory hour} = \left[\frac{\text{Total factory costs (TFC)}}{\text{Total time abailable on the key resource}}\right]$$

The return and cost per factory hour are combined into the throughput accounting ratio as follows:

$$TA = \left[\frac{\text{Return per factory hour (or minute)}}{\text{Cost per facgtory hour (or minute)}}\right]$$

The TA ratio should be greater than 1. If it is less than 1 the product will lose money for the company and the company should consider withdrawing it from the market. Using TA, value is not created until products are sold. Thus items made for stock produce no return and depress the TA ratio. This should prompt managers to use them limited bottleneck resource to produce products for which customer demand exists. The TA ratio can be considered in total terms and compares the total return from the throughput to TFC, i.e.,

$$\text{Primary TA Ratio} = \left[\frac{\text{Return from total throughput (i.e., Sales-Material Costs)}}{\text{(TFC(i.e., all costs other than materials)}}\right]$$

Problems with throughput accounting:

1. When throughput accounting is the driving force behind all production scheduling, a customer that has already placed an order for a product, which will result in a sub-optimal profit level for the manufacturing, may find that its order is never fled.
2. The company's ability to create the highest level of profitability is now dependent on the production scheduling staff, who decides, what products are to be manufactured and in what order.

3. Another issue is that all costs are totally variable in the long-run since the management then, has the time to adjust them to long-range production volumes.

Reporting under throughput accounting:

When the throughput model is used for financial reporting purposes, the format appears slightly different. The income statement includes only direct materials in the cost of goods sold, which results in a 'throughput contribution instead of gross margin. All other costs are jumped into an 'Operating Expenses' category below the throughput contribution margin, yielding a net income figure at the bottom. All other financial reports stay the same. Though this single change appears relatively minor, it has significant impact. The primary change is that throughput accounting does not charge any operating expenses to inventory so that they can be expressed in future period. Instead, all operating expenses are realized during the current period. As a result, any incentive for managers to over produce is completely eliminated because they cannot use the excess amount to shift expenses out of current period, thereby making their financial results look better than they would otherwise. Though this is a desirable result, such a report can be used only for internal reporting because of the requirement of generally acceptedaccounting principles that some overheads should be charged to excess production.

Illustration 1

Modern Co produces 3 products, A, B and C, details of which are shown below:

Particulars	**A**	**B**	**C**
Selling price per unit (₹)	120	110	130
Direct material cost per unit (₹)	60	70	85
Variable overhead (₹)	30	20	15
Maximum demand (units)	30,000	25,000	40,000
Time required on the bottleneck	5	4	3
resource (hours per unit)			

There are 3,20,000 bottleneck hours available each month.

Required:

Calculate the optimum product mix based on the throughput concept.

Solution:

Particulars	**A**	**B**	**C**
Selling price per unit (₹)	120	110	130
Direct material cost per unit (₹)	60	70	85
Throughput per unit (₹)	60	40	45
Time required on the bottleneck resource (hours per unit)	5	4	3
Return per factory hour (₹)	12	10	15
Ranking	2	3	1
Total Available hours		= 3,20,000	

(-) Hours used for C (40,000 x 3) = 1,20,000

(-) Hours used for A (30,000 x 5) = 1,50,000 = 2,70,000

Balance hours available for B = 50,000

No. of units that can be made in balance hours = 50,000/4 = 12,500 units.

Statement showing optimum mix:

	A	**B**	**C**
No. of units	30,000	12,500	40,000

Illustration 2

Cat Co makes a product using three machines – X, Y and Z. The capacity of each machine is as follows:

	X	Y	Z
Machine capacity per week (in units)	800	600	500

The demand for the product is 1,000 units per week. For every additional unit sold per week, profit increases by ₹ 50,000. Cat Co is considering the following possible purchases (they are *not* mutually exclusive):

Purchase 1 Replace machine X with a newer model. This will increase capacity to 1,100 units per week and costs ₹ 60 Lakhs.

Purchase 2 Invest in a second machine Y, increasing capacity by 550 units per week. The cost of this machine would be ₹ 68 Lakhs.

Purchase 3 Upgrade machine Z at a cost of ₹ 75 Lakhs, thereby increasing capacity to 1,050 units.

Required:

Which is Cat Co's best course of action under throughput accounting?

Solution:

Bottleneck resource in order of preference is firstly machine 'Z', secondly machine 'Y' and lastly machine 'X' because the no. of units are in that order in the existing capacity.

Particulars	X	Y	Z	Demand
Current capacity per week	800	600	500*	1,000
Buy Z	800	600*	1,050	1,000
Buy Z & Y	800*	1,150	1,050	1,000
Buy Z, Y & X	1,100	1,150	1,050	1,000*

* = bottleneck resource

All the three machines to be purchased in the above order to meet the existing demand.

Illustration 3

A factory has a key resource (bottleneck) of Facility A which is available for 31,300 minutes per week. Budgeted factory costs and data on two products, X and Y, are shown below:

Product	Selling Price/Unit	Material Cost/Unit	Time in Facility A
X	₹ 35	₹ 20.00	5 minute
Y	₹ 35	₹ 17.50	10 minutes

Budgeted factory costs per week:

	₹
Direct labour	25,000
Indirect labour	12,500
Power	1,750
Depreciation	22,500
Space costs	8,000
Engineering	3,500
Administration	5,000

Actual production during the last week is 4,750 units of product X and 650 units of product Y. Actual factory cost was ₹ 78,250.

Calculate:

(i) Total factory costs (TFC)

(ii) Cost per Factory Minute

(iii) Return per Factory Minute for both products

(iv) TA ratios for both products.

(v) Throughput cost per the week.

(vi) Efficiency ratio

Solution:

(i) Total Factory Costs = Total of all costs except materials.

= ₹ 25,000 + ₹ 12,500 + ₹ 1,750 + ₹ 22,500 + ₹ 8,000 + ₹ 3,500 + ₹ 5,000.

= ₹ 78,250

(ii) Cost per Factory Minute = Total Factory Cost ÷ Minutes available

= ₹ 78,250 ÷ 31,300 = ₹ 2.50

(iii)

(a) Return per bottleneck minute for Product X = $\frac{\text{Selling Price} - \text{Material Cost}}{\text{Minutes in bottleneck}}$

= (35 – 20) / 5 = ₹ 3

(b) Return per bottleneck minute for Product Y = $\frac{\text{Selling Price} - \text{Material Cost}}{\text{Minutes in bottleneck}}$

= (35 – 17.5) / 10 = ₹ 1.75

(iv) Throughput Accounting (TA) Ratio for Product X = $\frac{\text{Return per Minute}}{\text{Cost per Minute}}$

= (3 / 2.5) = ₹ 1.2

Throughput Accounting (TA) Ratio for Product Y = $\frac{\text{Return per Minute}}{\text{Cost per Minute}}$

= (1.75 / 2.5) = ₹ 0.7

Based on the review of the TA ratios relating to two products, it is apparent that if we only made Product Y, the enterprise would suffer a loss, as its TA ratio is less than 1. Advantage will be achieved, when product X is made.

(v) Standard minutes of throughput for the week:

= [4,750 x 5] + [650 x 10] = 23,750 + 6,500 = 30,250 minutes

Throughput cost per week:

= 30,250 x ₹ 2.5 per minutes

= ₹ 75,625

(vi) Efficiency % = (Throughput cost / Actual TFC) %

= (₹ 75,625 / ₹ 78,250) x 100

= 96.6%

The bottleneck resource of Facility A is available for 31,300 minutes per week but produced only 30,250 standard minutes. This could be due to:

(a) the process of a 'wandering' bottleneck causing facility A to be underutilized.

(b) inefficiency in facility A.

Illustration 4

Given below is the basic data relating to New India Company for three years:

	Year1	Year 2	Year 3
Production and Inventory data			
Planned production (in units)	2,500	2,500	2,500
Finished goods inventory (in units), Jan 1	0	0	750
Actual production (in units)	2,500	2,500	2,500
Sales (in units)	2,500	1,750	3,250
Finished goods inventory (in units), Dec 31	0	750	0
Revenue and cost data, all three-years			
Sales price per unit			₹ 48
Manufacturing costs per unit			
Direct material			12
Direct labour			8
Variable manufacturing overhead			4
Total variable cost per unit			24
Used only under absorption costing:			
Fixed manufacturing overhead = Annual fixed OH / Annual Production			12
= ₹ 30,000 / ₹ 2,500			
Total absorption cost per unit			₹ 36
Variable selling and administrative cost per unit			
Fixed selling and administrative cost per year			₹ 4
			₹ 5,000

You are required to Prepare:

(a) Absorption Costing Income Statement

(b) Variable Costing Income Statement.

(c) Reconciliation of Income under Absorption and Variable Costing.

(d) Throughput Costing Income Statement and Comment how it is relatively more useful.

Draw your conclusion.

Solution:

(a) Absorption Costing Income Statement

New India Company

Income Statement as per Absorption Costing

Particulars	**₹ Year1**	**₹ Year 2**	**₹ Year 3**
Sales revenue (at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Cost of goods sold (at absorption cost of ₹ 36 per unit)	90,000	63,000	1,17,000
Gross margin	30,000	21,000	39,000
Less: Selling and administrative expenses:			
Variable (at ₹ 4 per unit)	10,000	7,000	13,000
Fixed	5,000	5,000	5,000
Operating Income	15,000	9,000	21,000

(b) Variable Costing Income Statement

New India Company

Income Statement as per Variable Costing

Particulars	**Year1** (₹)	**Year 2** (₹)	**Year 3** (₹)
Sales revenue (at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Variable expenses:			
Variable manufacturing costs			
(at variable cost of ₹ 24 per unit)	60,000	42,000	78,000
Variable selling & admn. Costs	10,000	7,000	13,000
(at ₹ 4 per unit)			
Contribution margin	50,000	35,000	65,000
Less: Fixed expenses :			
Fixed manufacturing overhead	30,000	30,000	30,000
Fixed selling & admn. Expenses	5,000	5,000	5,000
Operating Income	15,000	0	30,000

(c) Reconciliation of Income under Absorption and Variable Costing

New India Company
Reconciliation of Income under Absorption and Variable Costing

Particulars	**Year1** (₹)	**Year 2** (₹)	**Year 3** (₹)
Cost of goods sold under absorption costing	90,000	63,000	1,17,000
Variable manufacturing costs under variable costing	60,000	42,000	78,000
Difference	30,000	21,000	39,000
Fixed manufacturing overhead as a period expense under variable costing.	30,000	30,000	30,000
Balance	0	(9,000)	9,000
Operating Income under variable costing	15,000	0	30,000
Operating income under absorption costing	15,000	9,000	21,000

Difference in operating income	0	(9,000)	9,000

The following table shows, this difference in the amount of fixed overhead expenses explains the difference in reported income under absorption and variable costing:

Year	Change in Inventory (in units)	Fixed Overhead Rate	Difference in Fixed Overhead Expenses	Absorption Costing Income Minus Variable Costing Income
Year 1	0	x ₹ 12 =	= 0	= 0
Year 2	750 increase	x ₹ 12 =	= ₹ 9,000	= ₹9,000
Year 3	750 decrease	x ₹ 12 =	= (9,000)	= (9,000)

(d) Throughput Costing Income Statement

New India Company

Income Statement as per Throughput Costing

Particulars	Year1 (₹)	Year 2 (₹)	Year 3 (₹)
Sales revenue (at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Cost of goods sold (at throughput cost: Direct – material cost)[1]	30,000	21,000	39,000
Throughput	90,000	63,000	1,17,000
Less: Operating costs:			
Direct labour	20,000	20,000	20,000
Variable manufacturing overhead	10,000	10,000	10,000
Fixed manufacturing overhead	30,000	30,000	30,000
Variable Selling & Admn. Costs	10,000	7,000	13,000
Fixed selling & Admn. Costs	5,000	5,000	5,000
Total Operating costs	75,000	72,000	78,000
Operating Income	15,000	(9,000)	39,000

Notes:

1. Standard direct-material cost per unit of ₹ 12 multiplied by sales volume in units.
2. Assume that management has committed to direct labour sufficient to produce the planned annual production volume of 2500 units; direct labour cost is used at a rate of ₹ 8 per unit produced.
3. Assumes management has committed to support resources sufficient to produce the planned annual production volume of ₹ 2500 units; variable overhead cost is used at a rate of ₹ 4 per unit produced. Fixed overhead is ₹ 30,000 per year.
4. Variable selling and administrative costs used amount to ₹ 1 per unit sold. Fixed selling and administrative costs are ₹ 5,000 per year.

Illustration 5

T Ltd, produces a product which passes through two processes - cutting and finishing.

The following information is provided:

	Cutting	Finishing
Hours available per annum	50,000	60,000
Hours needed per unit of product	5	12
Fixed operating costs per annum excluding direct material	10,00,000	10,00,000

The selling price of the product is ₹ 1,000 per unit and the only variable cost per unit is direct material, which costs ₹ 400 per unit. There is demand for all units produced.

Evaluate each of the following proposals independent of each other:

(i) An outside agency is willing to do the finishing operation ot any number of units between 5,000 and 7,000 at ₹400 per unit.

(ii) An outside agency is willing to do the cutting operation of 2,000 units at ₹ 200 per unit.

(iii) Additional equipment for cutting can be bought for ₹ 10,00,000 to increase the cutting facility by 50,000 hour, with annual fixed costs increased by ₹ 2 lakhs.

Answer:

Cutting process capacity = 50,000 hours/5 = 10,000 units

Finishing process capacity = 60,000 hours/12 = 5,000 units

Throughput contribution per unit = Selling price - Material cost

= ₹ 1,000 - ₹ 400 = ₹ 600p.u.

Alternative-I If an outside agency is willing to do the finishing operation

Increase in throughput contribution

= (Throughput contribution - Subcontracting charges) x No. of finished units

= (₹ 600 - ₹ 400) x 5,000 units = ₹ 10,00,000

Alternative-II If an outside agency is willing to do the cutting operation

Already the cutting process has got surplus capacity. It is not a bottleneck. It is not suggested to outsource cutting operation, since there is no benefit to TP Ltd. from outsourcing, and outsourcing of cutting process will reduce the throughput contribution of outsourced activity.

Alternative-III Installation of additional equipment for cutting process.

The cutting process has surplus capacity. It is not suggested to increase non-bottleneck capacity.

Illustration 6

H Ltd. manufactures three products. The material cost, selling price and bottleneck resource details per unit are as follows:

Particulars		Product X	Product Y	Product
Selling price	(₹)	66	75	90
Material and other variable cost	(₹)	24	30	40
Bottleneck resource time	(minutes)	15	15	20

Budgeted factory costs for the period are ₹ 2,21,600. The bottleneck resources time available is 75,120 minutes per period.

Required:

(i) Company adopted throughput accounting and products are ranked according to 'product return per minute'.

Select the highest rank product.

(ii) Calculate throughput accounting ratio and comment on it.

Answer:

(i) Calculation of Rank according to product return per minute

(₹)

Particulars		X	Y	Z
Selling price		66	75	90
Less: Variable cost		24	30	40
Throughput contribution	(a)	42	45	50
Minutes per unit	(b)	15	15	20
Contribution per minute	(a) ÷ (b)	2.8	3	2.5
Ranking		II	I	III

(ii) Calculation of Throughput Accounting ratio

Particulars	X	Y	Z
Factory cost per minute (₹ 2,21,600/75,120 minutes) (₹)	2.95	2.95	2.95
TA ratio (Contribution per minute/Cost per minute)	0.95	1.02	0.85
Ranking based on TA ratio	II	I	III

Analysis - Product Y yields more contribution compared to average factory contribution per minute, whereas X and Z yield less. J

KAIZEN COSTING

Introduction:

The initial VE review may not be complete and perfect in all cost aspects. There may be further chances of waste reduction, cost and time reduction and product improvement. Such continuous cost reduction technique is called as Kaizen Costing.

The review of product costs under the target costing methodology is not reserved just for the period up to the completion of design work on a new product. There are always opportunities to control costs after the design phase is completed, though these opportunities are fewer than during the design phase.

Meaning: Kaizen Costing refers to the ongoing continuous improvement program that focuses on the reduction of waste in the production process, thereby further lowering costs below the initial targets specified during the design phase. It is a Japanese term for a number of cost reduction steps that can be used subsequent to issuing a new product design to the factory floor.

Process of Kaizen Costing: Activities in Kaizen Costing include elimination of waste in production, assembly, and distribution processes, as well as the elimination of unnecessary work steps in any of these areas. Thus Kaizen Costing is intended to repeat many of the value engineering steps, continuously and constantly refining the process, thereby eliminating out extra costs at each stage.

Kaizen Costing Vs Value Engineering: Cost reductions resulting from Kaizen Costing are much smaller than those achieved with value engineering. But these are still significant since competitive pressures are likely to force down the price of a product over time, and any possible cost savings allow a Company to still attain its targeted profit margins.

Multiple Versions of Products - Continuous Kaizen Costing: Multiple improved versions of products can be introduced to meet the challenge of gradually reducing costs and prices. The market price of products continues to drop over time, which forces a Company to use both target and kaizen costing to reduce costs and retain its profit margin. However, prices eventually drop to the point where margins are reduced, which forces the Company to develop a new product with lower initial costs and for which kaizen costing can again be used to further reduce costs. This pattern may be repeated many times as a Company forces its costs down through successive generations of products.

Experience of Kaizen Costing in Toyota.

Toyota's Experience of Kaizen Costing: Toyota aggressively pursued Kaizen Costing to reduce costs in the manufacturing phase. In July and January, Plant Managers submit six months plan for attaining their kaizen goal. Methods for achieving these goals include cutting material costs per unit and improvement in standard operating procedures. These are pursued based on employee's suggestions. For improvements involving industrial engineering and value engineering, employees often receive support from technical staff. To draw up a Kaizen plan after Kaizen goals have been set by top management, employees look for ways to contribute to Kaizen in their daily work. About two million suggestion were received from Toyota employees in t\one recent year alone roughly thirty-five per employee. Ninety-seven percent of them were adopted. This is really a prime example of concept of employee empowerment in which workers are encouraged to take their own initiatives to improve operations, reduce costs, and improve product quality and customer service.

Kaizen Costing and Standard Costing

Standard Costing is used in conjunction with management by exception (management's attention is directed towards situations where actual results differ from expected results). The expected results are based on standards, which have been derived from the capability of current organizational processes. Standard costing, therefore, reflects current level of performance and fails to provide any motivation to improve.

Basis of Difference	Standard Costing	Kaizen Costing
Concepts	It is used for cost control	It is used for cost reduction.
	It is assumed that current manufacturing conditions remain unchanged.	It assumes continuous improvement.
	The cost focus is on standard costs based on static conditions	The cost focus is on actual costs assuming dynamic conditions
	The aim is to meet cost performance standards	The aim is to achieve cost reduction targets.
Techniques	Standards are set every six or twelve months	Cost reduction targets are set and applied monthly
	Costs are controlled using variance analysis based on standard and actual costs.	Costs are reduced by implementing continuous improvement (kaizen) to attain the target profit or to reduce the gap between target and estimated profit.
	Management should investigate and respond when standards are not met.	Management should investigate and respond when target kaizen amount are not attained.
Employees	They are often viewed as the cause of problems	They are viewed as the source of, and are empowered to find, the solutions.

BUSINESS PROCESS RE-ENGINEERING

Meaning of Business Process Re-engineering

Business Process Re-engineering (BPR) refers to the fundamental rethinking and redesign of business processes to achieve improvement in critical measures of performance such as cost, quality, service, speed and customer satisfaction. In contrast the concept of Kaizen, which involves small, incremental steps towards gradual improvement, re-engineering involves a giant leap. It is the complete redesign of a process with an emphasis on finding creative new way to accomplish an objective. It has been described as taking a blank piece of paper and starting from scratch to redesign a business process. Rather than searching continually for minute improvement, re-engineering involves a radical shift in thinking about how an objective should be met. Re-engineering prescribes radical, quick and significant change. Admittedly, it can entail high risks, but it can also bring big rewards. These benefits are most dramatic when new models are discovered for conducting business.

Characteristics and Principles of Re-engineering Process

Characteristics of Re-engineering Process

(i) Several jobs are combined into one
(ii) Often workers make decisions
(iii) The steps in the process are performed in a logical order
(iv) Work is performed, where it makes most sense
(v) Quality is built in.
(vi) Manager provides a single point of contact
(vii) Centralized and decentralized operations are combined.

Seven Principles of BPR:

(a) Processes should be designed to achieve a desired outcome rather than focusing on existing tasks.
(b) Personnel who use the output from a process should perform the process
(c) Information processing should be included in the work, which produces the information
(d) Geographically disperesed resources should be treated, as if they are centralized
(e) Parallel activities should be linked rather than integrated
(f) Doers should be allowed to be self-managing
(g) Information should be captured once at source.

An example of a business process: Credit card approval in a bank.

An applicant submits an application. The application is reviewed first to make sure that the form has been completed properly. If not, it is returned for completion. The complete form goes through a verification of information. This is done by ordering a report from a credit company and calling references. Once the information is verified, an evaluation is done. Then, a decision (yes or no) is made. If the decision is negative, an appropriate rejection letter is composed. If the decision is positive, an account is opened, and a card is issued and mailed to the customer. The process, which may take a few weeks due to workload and waiting time for the verifications, is usually done by several individuals.

Business processes are characterized by three elements:

The inputs, (data such customer inquiries or materials), **the processing** of the data or materials (which usually go through several stages and may necessary stops that turns out to be time and money consuming), and **the outcome** (the delivery of the expected result). The problematic part of the process is processing. Business process reengineering mainly intervenes in the processing part, which is reengineered in order to become less time and money consuming.

The term "Business Process Reengineering" has, over the past couple of year, gained Increasing circulation. As a result, many find themselves faced with the prospect of having to learn, plan, implement and successfully conduct a real Business Process Reengineering endeavor, whatever that might entail within their own business organization. Hammer and Champy (1993) define business process reengineering (BPR) as:

" the fundamental rethinking and **radical** redesign of **the business processes** to achieve **dramatic** improvements in critical, contemporary measures of performance, such as cost, quality, service and speed".

6 SIX SIGMA

Introduction

Six Sigma is a highly disciplined process that helps us focus on developing and delivering near-perfect products and services.

Features of Six Sigma

- Six Sigma's aim is to eliminate waste and inefficiency, thereby increasing customer satisfaction by delivering what the customer is expecting.
- Six Sigma follows a structured methodology, and has defined roles for the participants.
- Six Sigma is a data driven methodology, and requires accurate data collection for the processes being analyzed.
- Six Sigma is about putting results on Financial Statements.
- Six Sigma is a business-driven, multi-dimensional structured approach for:
    - o Improving Processes
    - o Lowering Defects
    - o Reducing process variability
    - o Reducing costs
    - o Increasing customer satisfaction
    - o Increased profits

The word Sigma is a statistical term that measures how far a given process deviates from perfection. The central idea behind Six Sigma: If you can measure how many "defects" you have in a process, you can systematically figure out how to eliminate them and get as close to "zero defects" as possible and specifically it means a failure rate of 3.4 parts per million or 99.9997% perfect.

Key Concepts of Six Sigma

At its core, Six Sigma revolves around a few key concepts.

Critical to Quality: Attributes most important to the customer.

Defect: Failing to deliver what the customer wants.

Process Capability: What your process can deliver.

Variation: What the customer sees and feels.

Stable Operations: Ensuring consistent, predictable processes to improve what the customer sees and feels.

Design for Six Sigma: Designing to meet customer needs and process capability.

Our Customers Feel the Variance, Not the Mean. So Six Sigma focuses first on reducing process variation and then on improving the process capability.

Myths about Six Sigma

There are several myths and misunderstandings surrounding Six Sigma. Some of them are given below:

- Six Sigma is only concerned with reducing defects.
- Six Sigma is a process for production or engineering.
- Six Sigma cannot be applied to engineering activities.
- Six Sigma uses difficult-to-understand statistics.
- Six Sigma is just training.

Benefits of Six Sigma

Six Sigma offers six major benefits that attract companies:

- Generates sustained success
- Sets a performance goal for everyone
- Enhances value to customers
- Accelerates the rate of improvement
- Promotes learning and cross-pollination
- Executes strategic change

Origin of Six Sigma

- Six Sigma originated at Motorola in the early 1980s, in response to achieving 10X reduction in productfailure levels in 5 years.
- Engineer Bill Smith invented Six Sigma, but died of a heart attack in the Motorola cafeteria in 1993, never knowing the scope of the craze and controversy he had touched off.
- Six Sigma is based on various quality management theories (e.g. Deming's 14 point for management, Juran's 10 steps on achieving quality).
- There are three key elements of Six Sigma Process Improvement:
- Customers
- Processes
- Employees

The Customers

Customers define quality. They expect performance, reliability, competitive prices, on-time delivery, service, clear and correct transaction processing and more. This means it is important to provide what the customers need to gain customer delight.

The Processes

Defining processes as well as defining their metrics and measures is the central aspect of Six Sigma. In a business, the quality should be looked from the customer's perspective and so we must look at a defined process from the outside-in. By understanding the transaction lifecycle from the customer's needs and processes, we can discover what they are seeing and feeling. This gives a chance to identify weak areas with in a process and then we can improve them.

The Employees

A company must involve all its employees in the Six Sigma program. Company must provide opportunities and incentives for employees to focus their talents and ability to satisfy customers. It is important to Six Sigma that all the team members should have a well-defined role with measurable objectives. Under a Six Sigma program, the members of an organization are assigned specific roles to play, each with a title. This highly structured format is necessary in order to implement Six Sigma throughout the organization. There are seven specific responsibilities or "role areas" in a Six Sigma program, which are as follows.

Leadership

A leadership team or council defines the goals and objectives in the Six Sigma process. Just as a corporate

leader sets a tone and course to achieve an objective, the Six Sigma council sets the goals to be met by the team. Here is the list of Leadership Council Responsibilities:

- Defines the purpose of the Six Sigma program
- Explains how the result is going to benefit the customer
- Sets a schedule for work and interim deadlines
- Develops a mean for review and oversight
- Support team members and defend established positions

Sponsor

Six Sigma sponsors are high-level individuals who understand Six Sigma and are committed to its success. The individual in the sponsor role acts as a problem solver for the ongoing Six Sigma project. Six Sigma is generally led by a full-time, highlevel champion, such as an Executive Vice President. Sponsors are the owners of processes and systems, who help initiate and coordinate Six Sigma improvement activities in their areas of responsibilities.

Implementation Leader

The person responsible for supervising the Six Sigma team effort, who supports the leadership council by ensuring that the work of the team is completed in the desired manner, is the Implementation Leader. Ensuring success of the implementation plan and solving problems as they arise, training as needed, and assisting sponsors in motivating the team are some of the key responsibilities of an implementation leader.

Coach

Coach is a Six Sigma expert or consultant who sets a schedule, defines result of a project, and who mediates conflict, or deals with resistance to the program. Duties include working as a go-between for sponsor and leadership, scheduling the work of the team, identifying and defining the desired results of the project, mediating disagreements, conflicts, and resistance to the program and identifying success as it occurs.

Team Leader

It is an individual responsible for overseeing the work of the team and for acting as a go-between with the sponsor and the team members. Responsibilities include communication with the sponsor in defining project goals and rationale, picking and assisting team members and other resources, keeping the project on schedule, and keeping track of steps in the process as they are completed.

Team Member

An employee who works on a Six Sigma project, given specific duties within a project, and has deadlines to meet in reaching specific project goals. Team members execute specific Six Sigma assignments and work with other members of the team within a defined project schedule, to reach specifically identified goals.

Process Owner

The individual who takes on responsibility for a process after a Six Sigma team has completed its work.

Extended Definitions of Roles – Belt Colors

The assignment of belt colors to various roles is derived from the obvious source, the martial arts. Based on experience and expertise, following roles have evolved over the years.

Note: The belt names are a tool for defining levels of expertise and experience. They do not change or replace the organizational roles in the Six Sigma process.

Black Belt

The person possessing this belt has achieved the highest skill level and is an experienced expert in various techniques. As applied to the Six Sigma program, the individual designated as a Black Belt has completed a thorough internal training program and has the experience of working on several projects. The black belt holder is usually given the role of a team leader, the person who is responsible for execution and scheduling.

Master Black Belt

A person who deals with the team or its leadership; but is not a direct member of the team itself. This may be equivalent to the role played by the coach, or for more technical and complex projects. The Master Black Belt is available to answer procedural questions and to resolve the technical issues that come up.

Green Belt

The Green Belt designation can also belong to the team leader or to a member of the team working directly with the team leader. A Green Belt is less experienced than a Black Belt but is cast in a key role within the team.

Methodology:

Six Sigma has two key methodologies: DMAIC and DMADV, both inspired by W. Edwards Deming's Plan-Do-

Check Act Cycle: DMAIC is used to improve an existing business process, and DMADV is used to create new product or process designs for predictable, defect-free performance.

DMAIC

Basic methodology consists of the following five steps:

- Define the process improvement goals that are consistent with customer demands and enterprise strategy.
- Measure the current process and collect relevant data for future comparison.
- Analyze to verify relationship and causality of factors. Determine what the relationship is, and attempt to ensure that all factors have been considered.
- Improve or optimize the process based upon the analysis using techniques like Design of Experiments.
- Control to ensure that any variances are corrected before they result in defects. Set up pilot runs to establish process capability, transition to production and thereafter continuously measure the process and institute control mechanisms.

DMIADV

Basic methodology consists of the following five steps:

- Define the goals of the design activity that are consistent with customer demands and enterprise strategy.
- Measure and identify CTQs (critical to qualities), product capabilities, production process capability, and risk assessments.
- Analyze to develop and design alternatives, create high-level design and evaluate design capability to select the best design.
- Design details, optimize the design, and plan for design verification. This phase may require simulations.
- Verify the design, set up pilot runs, implement production process and handover to process owners.
- Some people have used DMAICR (Realize). Others contend that focusing on the financial gains realized

Through Six Sigma is counter-productive and that said financial gains are simply byproducts of a good Process improvement.

Six Sigma process in Quality Control Process

Six Sigma is a set of practices originally developed by Motorola to systematically improve processes by eliminating defects. A defect is defined as non-conformity of a product or service to its specifications. While the particulars of the methodology were originally formulated by Bill Smith at Motorola in 1986, Six Sigma was heavily inspired by six preceding decades of quality improvement methodologies such as quality control, TQM, and Zero Defects. Like its predecessors, Six Sigma asserts the following:

(a) Continuous efforts to reduce variation in process outputs is key to business success

(b) Manufacturing and business processes can be measured, analyzed, improved and controlled

(c) Succeeding at achieving sustained quality improvement requires commitment from the entire organization, particularly from top-level management.

The term "Six Sigma" refers to the ability of highly capable processes to produce output within specification. In particular, processes that operate with six sigma quality produce at defect levels below 3.4 defects per (one) million opportunities (DPMO). Six Sigma's implicit goal is to improve all processes to that level of quality or better.

7 LEAN MANAGEMENT

Introduction:

What we now call lean manufacturing was developed by Toyota and other Japanese companies. Toyota executives claim that the famed Toyota Production System was inspired by what they learned during visits to the Ford Motor Company in the 1920s and developed by Toyota leaders such as Taiichi Ohno and consultant Shigeo Shingo after World War II. As pioneer American and European companies embraced lean manufacturing methods in the late 1980s, they discovered that lean thinking must be applied to every aspect of the company including the financial and management accounting processes.

Meaning:

Lean Accounting is the general term used for the changes required to a company's accounting, control, measurement, and management processes to support lean manufacturing and lean thinking. Most companies embarking on lean manufacturing soon find that their accounting processes and management methods are at odds with the lean changes they are making. The reason for this is that traditional accounting and management methods were designed to support traditional manufacturing; they are based upon mass production thinking. Lean manufacturing breaks the rules of mass production, and so the traditional accounting and management methods are (at best) unsuitable and usually actively hostile to the lean changes the company is making.

Classic examples of these kinds of problems are:

- Lean improvements showing cost increases as a result of the way standard costing applies labor and overhead costs. There is many an excellent lean strategy that has been cancelled or held back because the standard costing system shows a negative impact.
- Traditional performance measurements motivating the people to take anti-lean actions like building inventory, running large batches, "cherry picking" production jobs to maximize earned hours, combining jobs into more "efficient" runs, buying large (so called) economic order quantities of raw materials & components, and so forth. These problems are caused by measurements like labor efficiency, machine utilization, purchase price variance, and perhaps worst of all-overhead absorption variance (and other variances).

The lean team working hard to eliminate waste from the value stream only to find that profitability goes down owing to the adjustments made by significant inventory reduction. Looking at the other side of this same problem, the finance people are told about all the savings being made in operations but they see (at best) no financial improvement; and often a negative impact.

What is Lean Accounting? Is an oft-asked question. Everybody working seriously to implement lean thinking in their company eventually bumps up against their accounting systems. It soon becomes clear that traditional accounting systems are actively anti-lean.

- They are large, complex, wasteful processes requiring a great deal of non-value work.
- They provide measurements and reports like labor efficiency and overhead absorption that motivate large batch production and high inventory levels.
- They have no good way to identify the financial impact of the lean improvements taking place throughout the company. On the contrary, the financial reports will often show that bad things are happening when very good lean change is being made.

- Very few people in the company understand the reports that emanate from the accounting systems, and yet they are used to make important and far-reaching decisions.
- They use standard product (or service) costs which can be misleading when making decisions related to quoting, profitability, make/buy, sourcing, product rationalization, and so forth. Almost all companies implementing lean accounting are making poor decisions, turning down highly profitable work, out-sourcing products or components that should be made in house, manufacturing overseas products that can be competitively manufactured here at home etc.

A short example will illustrate why traditional accounting approaches can lead us to the wrong decisions. Let's assume a company runs a traditional standard costing system with a Standard Cost of ₹27 per piece made up of materials ₹12, labour ₹5 and overhead (absorbed on a labour hours basis) of ₹15. A request for quote comes in from a major potential customer for 10,000 pieces. The customer's target price is ₹29 per piece. Should we take the order ? In its standard costing system the company adds 15% to its standard cost when making quotes, thus it would quote this customer ₹31.05 per piece and not take the order.

Is this the right decision? The answer is we don't know. The Standard Cost approach doesn't tell us whether we have the spare capacity to produce the order, it doesn't tell us whether we have the potential to improve our Value Stream to produce the order and so on. In fact the Standard Cost tells us nothing.

What we actually need to do is take an incremental (marginal) costing approach to the decision. The materials to produce the extra product will cost ₹50,000 (at ₹5 each). If we have enough spare capacity in the Value Stream then there will be no extra labour cost, but let's assume we need to work ₹100,000 of overtime to complete the order. There won't be any extra overheads, but let's say there would be ₹25,000 of extra energy costs and consumables. Thus the incremental income from the order would be ₹290,000; and the incremental costs would be ₹175,000 (₹50,000 + ₹100,000 + ₹25,000) = an extra ₹115,000 contribution to profit.

Thus, based on Standard costing we would refuse a profitable order. Of course there are other factors to take into account - what impact would this price of ₹29 have on our other customers? Is this a one-off order or a potential long term relationship? etc etc. I am not saying that this approach gives us the whole picture, but it gives us more of the picture than a standard costing approach.

The purpose of lean accounting is to tell us about the flow through the Value Stream; to tell us about the capacity for extra work in the Value Stream; and to tell us about the incremental costs of alternative decisions and actions. Traditional accounting tells us nothing about these things.

Principles, Practices and Tools of Lean Accounting

Principles	Practices	Tools of lean accounting
A. Lean & simple business accounting	1. Continuously eliminate waste from the transactions processes, reports, and other accounting methods	(a) Value stream mapping; current & future state (b) Kaizen (lean continuous improvement) (c) PDCA problem solving
B. Accounting processes that support lean transformation	1. Management control & continuous improvement	(a) Performance Measurement Linkage Chart; linking metrics for cell/process, value streams, plant & corporate reporting to the business strategy, target costs, and lean improvement (b) Value stream performance boards containing break-through and continuous improvement projects (c) Box scores showing value stream performance
	2. Cost management	(a) Value stream costing (b) Value stream income statements
	3. Customer & supplier value and cost management	(a) Target costing

C. Clear & timely communication of information	1. Financial reporting	(a) "Plain English" financial statements (b) Simple, largely cash-based accounting
	2. Visual reporting of financial & non-financial performance measurements	(a) Primary reporting using visual performance boards; division, plant, value stream, cell/ process in production, product design, sales/ marketing, administration, etc.
	3. Decision-making	(a) Incremental cost & profitability analysis using value stream costing and box scores
D. Planning from a lean perspective	1. Planning & budgeting	(a) Hoshin policy deployment (b) Sales, operations, & financial planning (SOFP)
	2. Impact of lean improvement	(a) Value stream cost and capacity analysis (b) Current state & future state value stream maps (c) Box scores showing operational, financial, and capacity changes from lean improvement. Plan for financial benefit from the lean changes
	3. Capital planning	(a) Incremental impact of capital expenditure on value stream box-score. Often used with 3P approaches
	4. Invest in people	(a) Performance measurements tracking continuous improvement participation, employee satisfaction, & cross-training (b) Profit sharing
E. Strengthen internal accounting control	1. Internal control based on lean operational controls	(a) Transaction elimination matrix (b) Process maps showing controls and SOX risks
	2. Inventory valuation	(a) Simple methods to value inventory without the requirement for perpetual inventory records and product costs can be used when the inventory is low and under visual control.

While Lean Accounting is still a work-in-process, there is now an agreed body of knowledge that is becoming the standard approach to accounting, control, and measurement. These principles, practices, and tools of Lean Accounting have been implemented in a wide range of companies at various stages on the journey to lean transformation. These methods can be readily adjusted to meet your company's specific needs and they rigorously maintain adherence to GAAP and external reporting requirements and regulations. Lean Accounting is itself lean, low-waste, and visual, and frees up finance and accounting people's time so they can become actively involved in lean change instead of being merely "bean counters."

Companies using Lean Accounting have better information for decision-making, have simple and timely reports that are clearly understood by everyone in the company, they understand the true financial impact of lean changes, they focus the business around the value created for the customers, and Lean Accounting actively drives the lean transformation. This helps the company to grow, to add more value for the customers, and to increase cash flow and value for the stock-holders and owners.

8 SUPPLY CHAIN MANAGEMENT (PORTER'S VALUE CHAIN)

A supply chain is basically a group of independent organisations connected together through the products and services that they separately and/or jointly add value on in order to deliver them to the end consumer. It is very much an extended concept of an organisation which adds value to its products or services and delivers them to its customers. But what is the benefit of understanding the value adding from the supply chain perspective? Why managing supply chain is becoming necessary and important to todays business success? These are some of the fundamental questions that must be first addressed before discussing the "how to" questions.

Over the last three decades, the concept and theory of business management have undergone profound changes and development. Many old ways of doing business have been challenged and many new ideas and approaches have been created, among them are business process re- engineering, strategic management, lean thinking, agile manufacturing, balanced scorecard, blue ocean strategy, ... just to name a few. Supply chain management is undoubtedly one of those new and well grown management approaches emerged and rapidly developed across all industries around the world.

The earliest appearance of the term 'supply chain managemen? as we know it today published in recognisable media and literatures can be traced back to the early 1980s. More precisely, it first appeared in a Financial Times article written by Oliver and Webber in 1982 describing the range of activities performed by the organization in procuring and managing supplies. However the early publications of supply chain management in the 1980s were mainly focused on purchasing activities and cost reduction related activities. The major development and the significant increases of publications in the areas of supply chain integration and supplier-buyer relationship came in 1990s when the concept as we know it today was gradually established.

It is therefore clear that supply chain management is not one of the legacy academic subjects existed for hundreds or thousands of years, but rather a young and even nascent subject. It is only recently that business world started making use of this concept. So, the question is "Why now?" A convincing answer to this question is that our business environment has changed, which includes globalisation, more severe competition, heightened customer expectation, technological impact and geopolitical factors and so on. Under such a renewed business environment, an organisation focused management approach is no longer adequate to deliver the required competitiveness. Managers must therefore understand that their businesses are only part of the supply chains that they participated and it is the supply chain that wins or loses the competition.

Thus, the arena of competition is moving from 'organisation against organisation' to 'supply chain against supply chain'. The survival of any business today is no longer solely dependent on its own ability to compete but rather on the ability to cooperate within the supply chain. The seemingly independent relation between the organisations within the supply chain becomes ever more interdependent. You "sink or swim with the supply chain." It is for this reason that gives rise to the need for supply chain management.

Consequently, aspiring to become an excellent business simply through an entirely inward looking management approach can be very illusive. What's more practical and indeed more assured way of better managing a business is to managing it along with the supply chain through appropriate strategic positioning, adequate structural configuration, collaboration, integration and leadership. The paramount importance of doing so does not derive from the theories or reasoning, rather it is withstood by the business performance improvement and market measured customer results. It is the tangible benefits and success that it delivers makes the subject important.

Supply chain management is also pervasive and ubiquitous. One can hardly find any aspect of business that has nothing to do with supply chain management. Take an example of quality management - a very important part of todays business management, and ask yourself a question: can you manage and improve the quality

standard of your product or service measured by the end- consumer without managing the suppliers and buyers in the supply chain at all? Of course not. Business value creation is always a collective contribution from the whole involved supply chain.

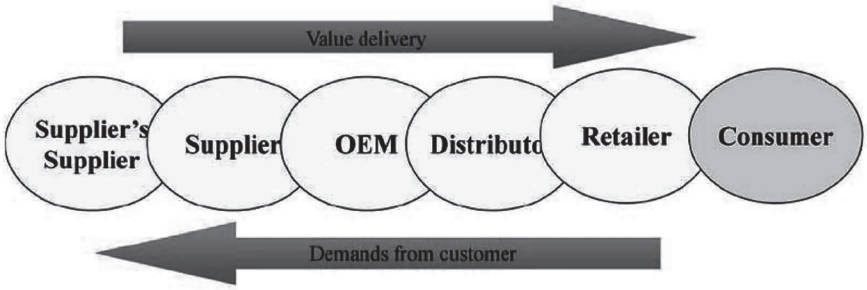
Defining supply chains

Ploughing through the plethora of literatures, one will come to realise that there are as many different definitions as many of those who cared to write about it. However, a broad conceptual consensus on the notion of Supply Chain (SC) and Supply Chain Management (SCM) is beyond anybody's reasonable doubt. Based on that, the author would like to offer his definition of SC here and SCM in the next section.

Supply chain is defined as a group of inter-connected participating companies that add value to a stream of transformed inputs from their source of origin to the end products or services that are demanded by the designated end-consumers.

In this definition, there are a number of key characteristics that have been used to portrait a supply chain. First, a supply chain is formed and can only be formed if there are more than one participating companies. Second, the participating companies within a supply chain normally do not belong to the same business ownership, and hence there is a legal independence in between. Third, those companies are inter-connected on the common commitment to add value to the steam of material flow that run through the supply chain. This material flow, to each company, comes in as the transformed inputs and goes out as the value added outputs.

Intuitively, one can imagine a supply chain as something resembles a "chain", in which the "links" are the participating companies that are inter-connected in the value adding process (see figure 1). The link on the upstream side of the material flow is the supplier's supplier; and on the downstream side of the material flow is the customer. There is usually an OEM - Original Equipment Manufacturer in between. The OEM sometimes is represented by OEM - Original Brand Manufacturer, or sometimes simply the "focal company."



At the end of a supply chain is the product and/or service that are created by the supply chain for the end consumer. Thus, the fundamental reason of a supply chains existence is hinged on to serving the end-consumer in the market place. The degree of how well a supply chain can serve their consumer ultimately defines its competitive edge in the market place.

It is understandable that in real-world a supply chain is much more complex than the one depicted in Figure 1. It is not really a "chain", rather it is more like a "network", when you consider that there are usually multiple suppliers and multiple customers for each participating companies in the chain. There are also possible nested chains within the chains. For example an engine manufacturing supply chain is a nested supply chain within the connected automobile supply chain.

Depend on how would like to see the supply chain, there are similar but different names you may like to call the supply chain. If you view a supply chain as basically a chain of value adding activities, you may like to call it "Value Chain"; if you perceive a supply chain as continuous demands originated from the consumer and stretched to upstream suppliers, you may like to call the supply chain the "Demand Chain".

Since the business connections between organisations are pervasive, how could one draw a boundary of a supply chain? In order to answer this question, one needs to understand the four intrinsic flows of a supply chain.

Material Flow: All manufacturing supply chains have material flows from the raw materials at the beginning of the supply chain to the finished products at the end of the supply chain. A furniture - making supply chain will have the wood cut down from forest at the beginning of its supply chain and home furniture at the end of supply chain. The continuous flow of wood been transformed through the chain and end up to furniture ties the whole supply chain together and defines its clear boundary. A furniture supply chain can never be confused with a

chocolate manufacturing supply chain because the material flows in between are clearly different and never will they cross with each other.

Information Flow: All supply chain s have and make use of information flows. Throughout a supply chain there are multitude of information flows such as demand information flow, forecasting information flow, production and scheduling information flows, and design and NPI information flows. Unlike the material flow the information can run both directions, towards upstream and downstream alike. Interestingly most of them are unique to the specific supply chain. The information of woman's fashion clothing has no value to a motorbike supply chain. Any supply chain will have its own set of information flows that are vital to its existence which are often jealously protected against those of other supply chains.

Finance Flow: All supply chain have finance flow. It is basically the money flow or the blood stream of a supply chain. Without it, a supply chain will surely demise. However, for any supply chain, there is only one single source of such finance flow - the en-consumer. This understanding of single source of finance has led to a concept of "single entity" perspective of a supply chain, which is a very useful foundation for supply chain integration and collaboration. The distribution and sharing of this single financial resource fairly across a supply chain will allow for the better alignment between the contribution and reward for the participating companies.

Commercial flow: All supply chain represents a transact!onal commercial flow. This means that the material flow that run through the supply chain changes its ownership from one company to anotheR, from supplier to buyer. The transactional process of buying and selling shifts the material flows ownership from the supplier to the buyer repeatedly until the end of the supply chain - the end- consumer. This transactional commercial flow will only take place in a supply chain where there are more than one companies. On the other hand, if it is with an organisation there will be material flow, but no ownership change, and hence no commercial flow.

The four flows described above not only better explain the function of the supply chain, but also define it more rigorously. They represent four major areas of concerns and research activities in the supply chain management, which covers most of the known issues in the published literatures.

Customer Orientation

Having understood the supply chain model, one may ask "Is the end-consumer a part of the supply chain?" Most people will say "Yes", because consumer give the demand information; consumer provide the financial reward and so on. But the author will argue that strictly speaking the end - consumer is NOT part of the supply chain; the supply chain only extend from the very raw material suppliers to the retailer (if that's the last link in the supply chain before the end-consumer). There are number of fundamental reasons to support this argument.

1) First, all supply chain supplies, and every member of the supply chain supplies; but the consumer DON'T, it demands instead of supply. The fundamental function of a supply chain is to supply; and the consumer is the recipient of the supply, but not a part of the supply. Supply chain's existence is based on the existence of the demand from the consumer. Supply chain treats consumer as the object which it serves. If a supply chain contains the consumer within itself, then it will have no object to serve and no recipient to take the supply; and it will lose its purpose of existence.

2) Second, a supply chain adds value to the product (or transformed inputs), but the consumer DON'T. Consumer consumes the product and depletes its market value. Used goods are always cheaper than the new ones. A supply chain and every member in it have the irrefutable duty to add values to the material flow, and they must learn how to improve the business and its management; but consumers will never need to do that. Their job is to use the money to vote which supply chain best satisfy their demand.

3) Third, a supply chain is always specialised and a consumer is always general. A computer manufacturing supply chain only produces computers, whilst a consumer will have to buy food, clothing, and automobile as well as computers. Due to the extremely divers nature of consumer s purchasing, to put the consumer as part of a supply chain will not be helpful in understanding the nature of a supply chain and may cause considerable confusion theoretically and logically.

Based on these three fundamental differences between the nature of supply chain and that of the consumer, it is more appropriate and less confusion if we separate the consumer away from the concept of the supply chain. This definition of supply chain without consumer will not deprive the immense benefits that consumer may contribute to the supply chain. How the end-consumer plays this pivotal role in the existence and the management of supply chain is the core notion of supply chain management.

The end-consumer to a supply chain is perhaps the most important factor of all as far as its management is concerned. Everything a supply chain does is driven by the needs and wants of the end-consumer. The contents of SCM are populated with the approaches, activities as well as the strategies that are aiming at delivering the products and services to satisfy the end-consumer. Therefore, it is safe to say that the SCM should be and has always been a customer centred management. This reflects the typical characteristic of supply chains customer orientation.

Not only the end-consumer serves as the ultimate objective, it also provides vital information and practical assistance to the decision making in the process of supply chain management. The end- consumers needs and wants, where they are, how many they are and how much they can afford and etc. give the supply chain manager some very precise guidance as how to achieve market responsiveness.

It is therefore beyond the shadow of doubt that supply chain and its management have always been, still are, and will certainly continue to be customer oriented. This customer orientation gives the fundamental reason and purpose of its existence. It also ensures that supply chain management has to be a system perspective based management approach that engages every participating member of the supply chain to align to the customer orientation.

Defining Supply Chain Management

Defining the supply chain management can be both dead easy and extremely difficult. It is dead easy because it is so widely known and widely practiced in almost all businesses. There is hardly a need to teach the "A, B, C" again. It is also extremely difficult because the definition must capture all what supply chain management in practice has reached far and wide. As an attempt, the author proffers the following definition:

Supply chain management is simply and ultimately the business management, whatever it may be in its specific context, which is perceived and enacted from the relevant supply chain perspective.

This definition squared out the nagging confusion between organisational business management and supply chain management. Rarely any aspect of organisational business management is not related to or influenced by the external firms in the supply chain. Thus the best way to manage the business is to take into consideration and engage with the external organisations in the decision making in order to achieve the ultimate business objectives - that means supply chain management.

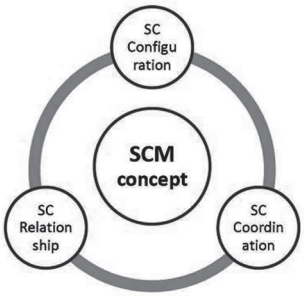
In other words, trying to identify a set of supply chain management activities that is not or nothing to do with any known business management activities would futile. The inception of the supply chain management concept did not create a new set of functional activities that has never been carried out before. What it created is a new way of understanding on how the business activities might be better carried out.

The supply chain management defined as such has already elevated the modern business management concept from the organisational focused domain to the supply chain focused system giving rise to more effectiveness in achieving the strategic objectives. Todays competition is no longer seen as the company against the company but the supply chain against the supply chain. Supply chain management is therefore a new perspective towards the old activities.

Introduction

This definition effectively explains why supply chain management can be done in such vastly diverse ways; why apparently completely different management activities can often be called supply chain management; why the same traditional management function is now been entitled as supply chain management; and so on. The answer is simply that because we start view the management issues and taking actions from the supply chain perspective.

This definition certainly gives the supply chain management concept a ubiquitous and pervasive nature. But, that does not mean that there is nothing uniquely identifiable on its own. One can still identify some practically very useful conceptual components of the supply chain management. Any supply chain management practice and activities is captured by the three conceptual components: Supply Chain Configuration; Supply Chain Relationship; and Supply Chain Coordination.



Supply Chain Management conceptual model

Supply Chain Configuration is about how a supply chain is constructed from all its participating firms. This includes how big is the supply base for OEM (original equipment manufacturer); how wide or narrow is the extent of vertical integration (which is the single ownership of consecutive activities along the supply chain); how much of the OEMs operations are outsourced; how the downstream distribution channel is designed; and so on. It is also known as supply chain architecture. The decision on supply chain configuration is strategic and at a higher level.

Supply Chain Relationship is about inter-firm relationships across the supply chain albeit the key focus of relationship is often around the OEM and its first tier suppliers and first tier customers and the relationship in between. The type and level of the relationship is determined by the contents of inter- organisational exchanges. The relationship is likely to be "arms length" if they only exchanged the volume and price of the transaction; on the other hand, the relationship would be regarded as close partnership if the parties exchanged their vision, investment planning, NPI process and detailed financial information. The decision on supply chain relationship is both strategic and operational.

Supply Chain Coordination refers mainly to the inter-firm operational coordination within a supply chain. It involves the coordination of continuous material flows from the suppliers to the buyers and through to the end-consumer in a preferably JIM manner. Inventory management throughout the supply chain could be a key focal point for the coordination. Production capacity, forecasting, manufacturing scheduling, even customer services will all constitute the main contents of the coordination activities in the supply chain. The decision on the supply chain coordination tends to be operational.

There is, however, one thing in common amongst the three key supply chain management focuses. That is they all deal with the external organisation in the same supply chain, which makes the concept more supply chain rather than organisationally internal. These concepts also tell us that supply chain management involves managerial decision making across strategic, tactic and operational levels - the pervasiveness. One may notice that all the major Operations Management text books will include a chapter or two on supply chain management, but that does not necessarily make the subject purely operational.

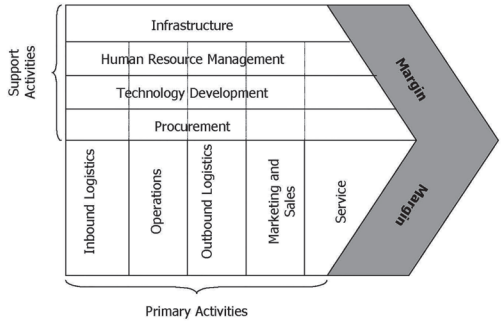
The Value Chain

The term Value Chain' was used by Michael Porter in his book "Competitive Advantage: Creating and Sustaining superior Performance" (1985). The value chain analysis describes the activities the organization performs and links them to the organizations competitive position.

Value chain analysis describes the activities within and around an organization, and relates them to an analysis of the competitive strength of the organization. Therefore, it evaluates which value each particular activity adds to the organizations products or services. This idea was built upon the insight that an organization is more than a random compilation of machinery, equipment, people and money. Only if these things are arranged into systems and systematic activates it will become possible to produce something for which customers are willing to pay a price. Porter argues that the ability to perform particular activities and to manage the linkages between these activities is a source of competitive advantage.

Porter distinguishes between primary activities and support activities. Primary activities are directly concerned with the creation or delivery of a product or service. They can be grouped into five main areas: inbound logistics, operations, outbound logistics, marketing and sales, and service. Each of these primary activities is linked to support activities which help to improve their effectiveness or effi- ciency. There are four main areas of support activities: procurement, technology development (including R&D), human resource management, and infrastructure (systems for planning, finance, quality, information management etc.).

The basic model of Porters Value Chain is as follows:

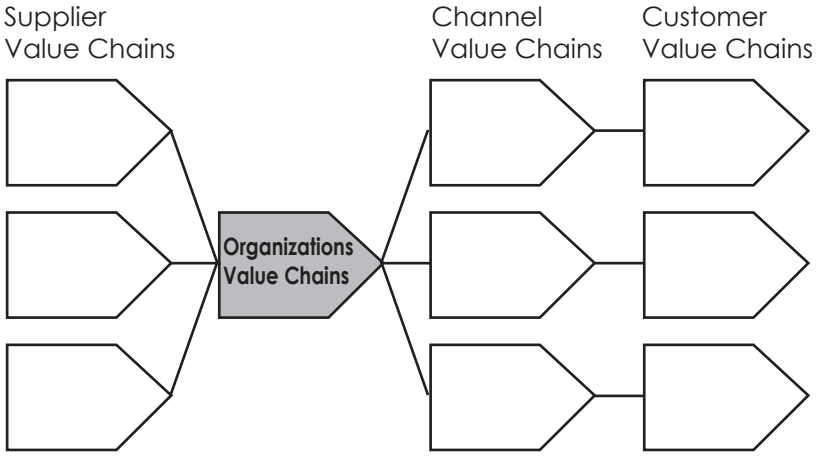


The term .Margin' implies that organizations realize a profit margin that depends on their ability to manage the

linkages between all activities in the value chain. In other words, the organization is able to deliver a product / service for which the customer is willing to pay more than the sum of the costs of all activities in the value chain.

Some thought about the linkages between activities: These linkages are crucial for corporate success. The linkages are flows of information, goods and services, as well as systems and processes for adjusting activities. Their importance is best illustrated with some simple examples: Only if the Marketing & Sales function delivers sales forecasts for the next period to all other departments in time and in reliable accuracy, procurement will be able to order the necessary material for the correct date. And only if procurement does a good job and forwards order information to inbound logistics, only than operations will be able to schedule production in a way that guarantees the delivery of products in a timely and effective manner- as pre-determined by marketing. In the result, the linkages are about seamless cooperation and information flow between the value chain activities.

In most industries, it is rather unusual that a single company performs all activities from product design, production of components, and final assembly to delivery to the final user by itself. Most often, organizations are elements of a value system or supply chain. Hence, value chain analysis should cover the whole value system in which the organization operates.



Within the whole value system, there is only a certain value of profit margin available. This is the dif- ference of the final price the customer pays and the sum of all costs incurred with the production and delivery of the product/service (e.g. raw material, energy etc.). It depends on the structure of the value system, how this margin spreads across the suppliers, producers, distributors, customers, and other elements of the value system. Each member of the system will use its market position and negotiating power to get a higher proportion of this margin. Nevertheless, members of a value system can cooperate to improve their efficiency and to reduce their costs in order to achieve a higher total margin to the benefit of all of them (e.g. by reducing stocks in a Just-In-Time system).

A typical value chain analysis can be performed in the following steps:

- Analysis of own value chain - which costs are related to every single activity
- Analysis of customers value chains - how does our product fit into their value chain
- Identification of potential cost advantages in comparison with competitors
- Identification of potential value added for the customer - how can our product add value to the customers value chain (e.g. lower costs or higher performance) - where does the customer see such potential

9 VALUE ENGINEERING

VALUE ANALYSIS AND VALUE ENGINEERING

Value Analysis

The Value Analysis (VA) technique was developed after the Second World War in America at General Electric during the late 1940s. Since this time the basic VA approach has evolved and been supplemented with new techniques that have become available and have been integrated with the formal VA process. Today, VA is enjoying a renewed popularity as competitive pressures are forcing companies to re-examine their product ranges in an attempt to offer higher levels of customization without incurring high cost penalties. In parallel, many major corporations are using the VA process with their suppliers to extend the benefits of the approach throughout the supply chain. Businesses, big and small, will therefore benefit from understanding and applying the VA process. It is likely that those companies that do not take the time to develop this capability will face an uncertain future as the lessons and problems of the past are redesigned into the products of the future.

Definition of Value Analysis

Value Analysis (VA) or Value Engineering (VE) is a function-oriented, structured, multi-disciplinary team approach to solving problems or identifying improvements. The goal of any VA Study is to:

-Improve value by sustaining or improving performance attributes

(of the project, product, and/or service being studied)

-while at the same time reducing overall cost

(including lifecycle operations and maintenance expenses).

Value Analysis can be defined as a process of systematic review that is applied to existing product designs in order to compare the function of the product required by a customer to meet their requirements at the lowest cost consistent with the specified performance and reliability needed.

This is a rather complicated definition and it is worth reducing the definition to key points and elements:

(i) Value Analysis (and Value Engineering) is a **systematic, formal and organized process of analysis and evaluation**. It is not haphazard or informal and it is a management activity that requires planning, control and co-ordination.

(ii) The analysis concerns the **function of a product** to meet the demands or application needed by a customer. To meet this functional requirement the review process must include an understanding of the purpose to which the product is used.

(iii) Understanding the **use of a product** implies that specifications can be established to assess the level of fit between the product and the value derived by the customer or consumer.

(iv) To succeed, the **formal management process must meet these functional specification** and performance criteria consistently in order to give value to the customer.

(v) In order to yield a benefit to the company, the formal review process must result in a **process of design improvements** that serve to lower the production costs of that product whilst maintaining this level of value through function.

Defining Cost and Value

Any attempt to improve the value of a product must consider two elements, the first concerns the use of the product (known as **Use value**) and the second source of value comes from ownership (**Esteem value**). This can be shown as the difference between a luxury car and a basic small car that each has the same engine. From a use point of view both cars conduct the same function – they both offer safe economical travel (**Use value**) – but the luxury car has a greater **esteem value**. The difference between a gold-plated ball pen and a disposable pen is another example. However, use value and the price paid for a product are rarely the same, the difference is actually the esteem value, so even though the disposable pen is priced at X the use value may be far less.

It is important for all managers to understand the nature of costs in the factory and for any given product. Whilst there is no direct relationship between 'Cost' (for the factory) and customer 'Value' in use and esteem, this education process is important. A shocking figure, that is often used as a general measure, is that typically 80% of the manufacturing costs of a product will be determined once the design drawing has been released for manufacturing.

The costs of production are therefore 'frozen' and determined at this point. These costs include the materials used, the technology employed, the time required to manufacture the product and such like. Therefore, the design process creates many constraints for the business and fixes a high degree of the total product cost. It is therefore a process that demands periodic review in order to recover any 'avoidable' costs that can be removed throughout the life of the product (by correcting weaknesses or exploiting new processes, materials or methods) and lowering the costs of production whilst maintaining its Use value to the customer.

Basically, there are three key costs of a product:

- **Cost of the parts purchased**: These are costs associated with the supply of parts and materials.
- **Cost of direct labour** used to convert products.
- **Cost of factory overheads** that recover the expenses of production.

Although there are three elements of total cost accumulation it is traditionally the case that cost reduction activities have focused on the labour element of a product. Activities such as work-study, incentive payments and automation have compressed labour costs and as a result there is little to be gained, for most companies, in attempting to reduce this further. Instead, comparatively greater gains and opportunities lie in the redesign and review of the products themselves to remove unnecessary materials and overhead costs. This approach to the 'total costs' of a product involves taking a much broader look at the way costs in the factory accumulate and the relationship between costs and value generation. These new sources of costs and evaluations would therefore include such sources as:

- **Cost of manufacture**
- **Cost of assembly**
- **Cost of poor quality**
- **Cost of warranty**

A detailed understanding of how costs are rapidly accumulated throughout the process of design to the despatch of the product is key to exploiting the process of VA. All VA activities are aimed at the reduction of avoidable and unnecessary costs, without compromising customer value, and therefore the VA process should target the largest sources of potential cost reduction rather being and indiscriminate or unsystematic process (such as focusing on labour alone). It is therefore preferable to take the holistic approach to understanding costs and losses in the 'entire system' of design and conversion of value in order to determine how to achieve customer service 'functionality' at a minimal cost per unit.

The Focus of Value Analysis

The key focus of the VA approach is therefore the management of 'functionality' to yield value for the customer. Let us emphasize this point a little. Not that long ago, consumers of electric kettles were offered a variety of different types of metal-based boiling device. The value of a kettle is derived through heating water and therefore its functionality can be determined (temperature, capacity, reliability, safety etc.). Now faced with the same functionality (to boil water), designers would probably look towards a kettle made of plastic.

Plastic has the same functionality as metal in terms of containing and boiling water. The action to boil water is conducted by the same part - known as the element. However the switch from metal to plastic does not

impair this value and functionality with the customer – they still want to boil water - but it does result in a cost saving for the manufacturing company. If a company that traditionally made metal kettles did not review its design process then it would be severely disadvantaged when attempting to compete against the lower cost plastic alternative. This is a simple example used only to provide an illustration of the VA concept but it does demonstrate the point of maintaining value whilst reducing costs.

If a company seeks to reduce the costs of producing a product then it must seek out costs that are unnecessary or items of the product that provide no functional value to the customer. If you adopt this approach then the VA process is concerned with removing a specific type of cost. This cost is one that can be removed without negatively affecting the function, quality, reliability, maintainability or benefit required by the customer. As such, the target for all VA activities is to find these costs as opposed to simply re-engineering a product design with no real purpose to the re-engineering exercise. The VA approach is therefore formal and systematic because it is directed towards highlighting and dealing with these 'recoverable costs' of production. The objective is to create value for money as opposed to creating new products that do not provide customer satisfaction but are relatively inexpensive.

The rules governing the application of the VA approach are therefore simple:

- **No cost can be removed if it compromises the quality of the product or its reliability**, as this would lower customer value, create complaints and inevitably lead to the withdrawal of the product or lost sales.
- **Saleability is another issue that cannot be compromised**, as this is an aspect of the product that makes it attractive to the market and gives it appeal value.
- **Any activity that reduces the maintainability of the product increases the cost of ownership** to the customer and can lower the value attached to the product.

Types of Value Analysis Exercises

VA for Existing Products

One of the best approaches to VA is simply to select an existing product that is sold in relatively large volumes. This product, or product family, will tend to have a great deal of the basic information, and documented history, which can be used quickly as opposed to a newly introduced product where such a history is not available. An existing product unites all the different managers in a business, each with an opinion and list of complaints concerning the ability to convert the design into a 'saleable' product. Therefore any team that is created for the purpose of VA will understand their own problems but not necessarily the cause of these problems across the entire business. These opinions regarding poor performance (and documented evidence of failures) are vital to the discussions and understanding of how the product attracts costs as it is converted from a drawing to a finished product. These discussions therefore allow learning to take place and allow all managers to understand the limitations to the scope of product redesign and re-engineering activities. These issues include:

- The inability to change existing product designs due to the need to redesign tooling and the expense of such an initiative.
- The project team may have a finite duration before the project is concluded and therefore time will dictate what can be achieved.
- The high levels of purchased costs may imply a need to engage with suppliers in the VA process. This initiative will be constrained by a number of issues such as the timing of the project, the availability of resources from the supplier, the location of the suppliers, and other constraints.

VA for New Products – Value Engineering

For new products, the team will need to modify the VA approach and will operate in an environment that is less certain and has poor levels of available information upon which to make decisions. In this case, the analysis and systematic process of review for new products is known as Value Engineering (VE). The VE approach is similar to that of Value Analysis but requires a much greater level of investment by the organization in terms of the skilled, experienced and proficient human resources seconded to the group.

VA for Product Families- Horizontal Deployment

The final form of VA is results when there is scope for the 'horizontal deployment' of the results of a VA exercise with a single product or family of products. Under conditions where the value analysis project team finds commonalties with many products manufactured by the company, then it is possible to extend the benefits to all these other products concurrently. In this manner, all affected products can be changed quickly to bring

major commercial benefits and to introduce the improvement on a 'factory-wide basis'. This is particularly the case when supplying companies offer improvements that affect all the products to which their materials or parts are used. The horizontal deployment activity has many advantages both in terms of financial savings and also the relatively short amount of time required to introduce the required changes to the product design.

Competitive VA

VA techniques are not simply the prerogative of the business that designed the product. Instead VA is often used as a competitive weapon and applied to the analysis of competitor products in order to calculate the costs of other company's products. This is often termed 'strip down' but is effectively the reverse value analysis. Here the VA team are applied to understanding the design and conversion costs of a competitor product. The results of the analysis is to understand how competitor products are made, what weaknesses exist, and at what costs of production together with an understanding of what innovations have been incorporated by the competitor company.

It is recommended that the best initial approach, for companies with no real experience of VA, is to select a single product that is currently in production and has a long life ahead. This approach offers the ability to gain experience, to learn as a team, and to test the tools and techniques with a product that has known characteristics and failings. In the short term it is most important to develop the skills of VA, including understanding the right questions to ask, and finally to develop a skeleton but formal process for all VA groups to follow and refine.

How to use Value Analysis

Keys to Success

There are many keys to the success of a VA programme and it is wise to consider these issues before commencing the project, as errors in the project plan are difficult to correct, without causing frustration, once the VA project has started. One of the most important initial steps in developing the VA process is to create a formal team of individuals to conduct the exercise. These individuals must be drawn from different parts of the business that affect the costs associated with design, manufacturing, supply and other relevant functions. In addition, the team must be focused on a product or product family in order to begin the exercise. Further key success factors include:

- **Gain approval of senior management** to conduct a Value Analysis exercise. Senior management support, endorsement and mandate for the VA project provides legitimacy and importance to the project within the business. This approval process also removes many of the obstacles that can prevent progress from being made by the team.
- **Enlist a senior manager as a champion** of the project to report back directly to the board of directors and also to act as the programme leader.
- Once a programme team has been developed it is important to **select an operational leader** to co-ordinate the efforts, monitor progress and to support the project champion.

This leader will remain with the VA team throughout the life of the project and will be the central linking pin between the team and the senior management champion.

- **Establish the reporting procedure** for the team and the timing of the project. This project plan needs to be formal and displayed as a means of controlling and evaluating achievements against time.
- **Present the VA concept and objectives of the team to all the middle and senior managers** in the business. Widespread communication of the VA project is important so that other employees, particularly managers (who may not be involved directly with the process) understand the need to support the project either directly by assigning staff or indirectly through the provision of data.
- Maintain a list of those business functions that should receive a **regular communication of progress** even though they may not be directly involved with the project. This process allows other individuals in the business to be informed about the progress and findings of the group. This form of promotion is important as it maintains a momentum and communicates the findings of the team as widely as possible.
- **Provide an office space and co-locate the team members** where practical and possible to do so. The ability to locate a VA improvement group in one area of the business is important and assists the communication within the group. A convenient area can also be used to dismantle the product and also the walls of the area can be used to record, on paper charts, the issues that have been discovered by the team (and the associated actions that must be undertaken).
- **Select the product** for the first study. Ideally the existing product, or family of products, will be one that is established, sells in volume and has a relatively long life expectancy.

As such any improvement in the cost performance of the product will provide a large financial saving to the business.

- Write down the **objectives of the project** and the key project review points. Estimate the targets to be achieved by the project. These objectives provide a reference point and framework for the exercise. The objectives also focus attention on the outputs and achievements required by the company.
- **Select and inform any personnel** who will act in a part time or temporary role during the project. This process is used to schedule the availability of key specialist human resources to support the team throughout the duration of the project.
- **Train the team** in both the process of VA and also in basic team building activities. It is important that all members understand the nature of the project and its importance. The initial team building exercises are also a good way of understanding the attitude of all members to the project – especially those with reservations or a negative attitude to what can be achieved. As with most team exercises there is a requirement to allow the team to build and bond as a unit. It is often difficult for individuals, drawn from throughout the factory, to understand the language that is used throughout the business and also to understand the 'design to market' process when their own role impacts on a small section of this large and complex process.

Value Engineering

Value Engineering is an organized/systematic approach directed at analyzing the function of systems, equipment, facilities, services, and supplies for the purpose of achieving their essential functions at the lowest life-cycle cost consistent with required performance, reliability, quality, and safety. Society of Japanese Value Engineering defines VE as:

"A systematic approach to analyzing functional requirements of products or services for the purposes of achieving the essential functions at the lowest total cost".

Value Engineering is an effective problem solving technique. Value engineering is essentially a process which uses function analysis, team- work and creativity to improve value. Value Engineering is not just "good engineering." It is not a suggestion program and it is not routine project or plan review. It is not typical cost reduction in that it doesn't "cheapen" the product or service, nor does it "cut corners."

Value Engineering simply answers the question "what else will accomplish the purpose of the product, service, or process we are studying?". VE technique is applicable to all type of sectors. Initially, VE technique was introduced in manufacturing industries. This technique is then expanded to all type of business or economic sector, which includes construction, service, government, agriculture, education and healthcare.

Aadarsh Instruments, located in Ambala, is a medical instrument manufacturing company considered to apply Value Engineering in to the Focus Adjustment Knob in one of their model SL 250 for Slit Lamp in microscope. This microscope has found application in the field of eye inspection. The value engineering analysis may help company in running its export business of medical microscope. This firm is producing different types of microscopes which they export to various countries around the globe. All of the products manufactured here are conforming to the international standards. It is an ISO certified company.

The total savings after the implementation of value engineering are as given below:

- Cost before analysis — ₹ 29.99
- Total Cost of Nylon Knob — ₹ 18.40
- Saving per product — ₹ 11.59
- Percentage saving per product — 38.64%
- Annual Demand of the product — 8,000
- Total Annual Saving — ₹ 92,720
- Value Improvement — ₹ 62.98%

What are the steps to be followed for doing Value Engineering? How can you conclude the decision on the basis of the above Value Engineering?

Answer:

The following are the steps to be used for carrying out the Value Engineering exercise by Aadarsh Instruments in

their model SL 250 for Slit Lamp in Microscope for the Focus Adjustment Knob:

(i) Selection of the Product Plan.

(ii) Gathering Product Information

(iii) Functional Analysis

(iv) Creativity Phase and preparing the work-sheet

(v) Evaluation Sheet

(vi) Cost Analysis

(vii) Result and Conclusion

(viii) Implementation.

Conclusion: Value Engineering methodology is a powerful tool for resolving system failures and designing improvements in performance of any process, product, service or organization. In the Case Study discussed under the question, we have used the concept of Value Engineering to analyze the Focus Adjustment Knob of SL 250 Slit Lamp Microscope. With a critical evaluation of this study, we have been able to increase the value of the product by substituting another material in place of the one currently in use. The% value improvement is to the tune of 62.98% and the total annual saving has been ₹ 92,720.

The various advantages have been observed in terms of:

- Cost Reduction
- Increase in overall production
- Reduction in man-power
- Reduction in scrap.

Thus the cost has been brought down by a substantial margin and thereby the value of the product has been increased.

10 LEARNING CURVES

INTRODUCTION

Learning Curve Theory is concerned with the idea that when a new job, process or activity commences for the first time it is likely that the workforce involved will not achieve maximum efficiency immediately. Repetition of the task is likely to make the people more confident and knowledgeable and will eventually result in a more efficient and rapid operation. Eventually the learning process will stop after continually repeating the job. As a consequence the time to complete a task will initially decline and then stabilise once efficient working is achieved. The cumulative average time per unit is assumed to decrease by a constant percentage every time that output doubles. Cumulative average time refers to the average time per unit for all units produced so far, from and including the first one made.

Learning is the process by which an individual acquires skill, knowledge and ability. When a new product or process is started, the performance of a worker is not at its best and learning phenomenon takes place. As the experience is gained, the performance of a worker improves, time taken per unit activity reduces and his productivity goes up. This improvement in productivity of a worker is due to learning effect. Cost predictions especially those relating to direct labour cost must allow for the effect of learning process. This technique is a mathematical technique. It can be very much used to accurately and graphically predict cost. It is a geometrical progression, which reveals that there is steadily decreasing cost for the accomplishment of a given repetitive operation, as the identical operation is increasingly repeated. The amount of decrease is less and less with each successive unit produced. The slope of the decision curve can be expressed as a percentage. Experience curve, improvement curve and progress curve are other terms which can be synonymously used. Learning curve is essentially a measure of the experience gained in production of an article by an individual or organization. As more units are produced, people involved in production become more efficient than before. Each subsequent unit takes fewer man-hours to produce. The amount of improvement will differ with each type of article produced. This improvement or experience gain is reflected in a decrease in man-hours or cost.

PHASES IN LEARNING CURVE

The learning curve will pass through three different phases. In the first phase, there will be gradual increase in production rate until the maximum expected rate is reached and this phase is generally steep. In the second phase, the learning rate will gradually deteriorate because of the limitations of equipment. In the third phase, the production rate begins to decrease due to a reduction in customer requirements and increase in costs.

Under the Learning curve model, the cumulative average time per unit produced is assumed to fall by a constant percentage every time total output of the unit doubles. Learning curve is a geometrical operation, as the identical operation is increasingly repeated.

Learning curve is essentially a measure if the experience gained in production of an article by an organization. As more and more units re-produced, workers involved in production become more efficient than before. Each subsequent unit takes fewer manhours or produce. The Learning curve exists during a worker's start up or familiarization period on a particular job. After the limits of experimental learning are reached, productivity tends to stabilize and no further improvement is possible. The learning curve ratio can be calculated with the help of the following formula:

$$\text{Learning curve ratio} = \frac{\text{Average cost of first 2 units}}{\text{Average labour cost of first units}}$$

Areas of consequence:

- A Standard Costing system would need to set standard labour times after the learning curve had reached a plateau.
- A budget will need to incorporate a learning cost factor until the plateau is reached.
- A budgetary control system incorporating labour variances will have to make allowances for the anticipated time changes.
- Identification of the learning curve will permit the company to better plan its marketing, work scheduling, recruitment and material acquisition activities.
- The decline in labour costs will have to be considered when estimating the overhead apportionment rate.
- As the employees gain experience they are more likely to reduce material wastage.

Graphical presentation of learning curve

The learning curve (not to be confused with experience curve) is a graphical representation of the phenomenon explained by Theodore P. Wright in his "Factors Affecting the Cost of Airplanes", 1936. It refers to the effect that learning had on labour productivity in the aircraft industry, which translates into a relation between the cumulative number of units produced (X) and the average time (or labour cost) per unit (Y), which resulted in a convex downward slope, as seen in the adjacent diagram.

There is a simple rationalisation behind all this: the more units produced by a given worker, the less time this same worker will need to produce the following units, because he will learn how to do it faster and better. Therefore, when a firm has higher cumulative volume of production, its time (or labour cost) per unit will be lower. Wright's learning curve model is defined by the following function:

$$Y = aX^{\frac{Log_b}{Log_2}}$$

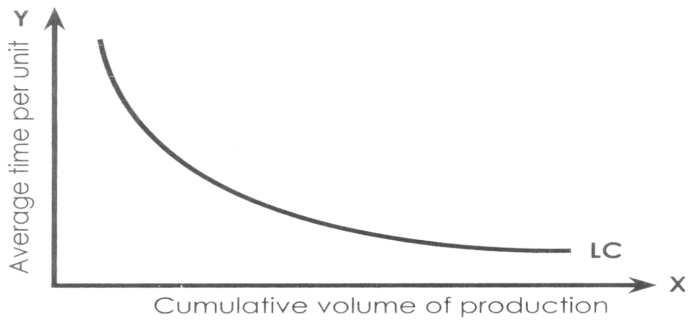
where:

Y = average time (or labour cost) per unit

a = time (or labour cost) per unit

X = cumulative volume of production

b = learning rate (%)



Some important implications arise from this curve. If the time (or labour cost) per unit decreases as the cumulative output increases, this will mean that firms that have been producing more and for a longer period, will have lower average time per unit and thus dominate the market.

USES OF LEARNING CURVE

Learning curve is now being widely issued in business. Some of the uses are as follows:

1. Where applicable the learning curve suggest great opportunities for cost reduction to be achieved by improving learning.
2. The learning curve concept suggests a basis for correct staffing in continuously expanding production. The curve shows that the work force need not be increased at the same rate as the prospective output. This also helps in proper production planning through proper scheduling of work; providing manpower at the right moment permitting more accurate forecast of delivery dates.
3. Learning curve concept provides a means of evaluating the effectiveness of training programs. What level of cumulative cost reduction do they accomplish? How does the learning curve for this group or shop compare with others? Whether any of the employees who lack the aptitude to meet normal learning curve should be eliminated.
4. Learning curve is frequently used in conjunction with establishing bid price for contracts. Usually, the bid price is based on the cumulative average unit cost for all the units to be produced for a given contract. If production is not interrupted. Additional units beyond this quantity should be costed at the increment costs incurred, and not at the previous cumulative average. If the contract agreement so provides, a contract may be cancelled and production stopped before the expected efficiency is reached. This would mean that the company having quoted on the basis of cumulative average unit cost is at a disadvantage because it cannot reap the benefit of leaning. The contractor must provide for these contingencies so that it will be reimbursed for such loss.
5. The use of learning curve, where applicable, is important in the working capital required. If the requirement is based on average cumulative unit cost, the revenues from the first few units may not cover the actual expenditures. For instance, if the price was based on the average cumulative unit cost of 328 hours the first unit when produced and sold will cause a deficit of 4.72 hours (8.00 - 3.28). Provision should therefore, be made to cover the deficit of working capital in the initial stages of production.
6. As employees become more efficient, the rate of production increases and so more materials are needed, the work-in-progress inventory turns over faster, and finished goods inventory grows at an accelerated rate. A knowledge of the learning curve assists in planning the inventories of materials. Work-in-progress, and finished goods.
7. Learning curve techniques are useful in exercising control, Variable norms can be established for each situation, and a comparison between these norms and actual expenses can be made. Specific or average incremental unit cost should be used for this purpose.
8. The learning curve may be used for make-or- buy decisions especially if the outside manufacturer has reached the maximum on the learning curve. Help to calculate the sensitive rates in wage bargaining.

LIMITATIONS OF THE USEFULNESS OF THE LEARNING CURVE

The following points limiting the usefulness of learning curves should be noted:-

1. The learning curve is useful only for new operations where machines do not constitute a major part of the production process. It is not applicable to all productions. E.g. new and experienced workmen.
2. The learning curve assumes that the production will continue without any major interruptions. If for any reason the work in interrupted, the curve may be deflected or assume a new slopes
3. Charges other than learning may effect the learning curve. For example, improvement in facilities, arrangements, and equipment as well as personnel morale and performance may be factors influencing the curve. On the other hand, negative developments in employee attitudes may also affect the curve and reverse or retard the progress of improvement.
4. The characteristic 80 percent learning curve as originally obtaining in the air force industry in U.S. A. has been usually accepted as the percentage applicable to all industries. Studies show that there cannot be a unique percentage which can be universally applied.

FACTORS AFFECTING LEARNING CURVE

1. While pricing for bids, general tendency is to set up a very high initial labour cost so as to show a high learning curve. This should the learning curve useless and sometimes misleading.
2. The method of production, i.e. whether it is labour oriented or machine oriented influences the slop of the learning.
3. When labour turnover rate is high management has to train new workers frequently. In such situations the company may never reach its maximum efficiency potential. One of the important requisites of the learning curve concept is that there should be uninterrupted flow of work. The fewer the interruptions, the grater will be the improvement in efficiency.
4. Changes in a product or in the methods of production, designs, machinery, or the tools/used affect the slope of the learning curve. All these have the effect of starting learning a fresh because of new conditions If the changes are frequent, there may be no learning at all.
5. Also other factors influencing the learning curve are labour strikes, lock outs and shut downs due to other cause also/affect the learning curve. In each such case there is interruption in the progress of learning.

As far as possible the effects of above factors should be carefully separated from the data used to establish the curve. The effects of these factors must also be separated from the actual costs used to measure the performance. Unless this is done analysis of the projected cost or the actual cost will not be meaningful.

THE EXPERIENCE CURVE

The more experience a firm has in producing a particular product, the lower its costs

The experience curve is an idea developed by the Boston Consulting Group (BCG) in the mid-1960s. Working with a leading manufacturer of semiconductors, the consultants noticed that the company's unit cost of manufacturing fell by about 25% for each doubling of the volume that it produced. This relationship they called the experience curve: the more experience a firm has in producing a particular product, the lower are its costs. Bruce Henderson, the founder of BCG, put it as follows:

Costs characteristically decline by 20-30% in real terms each time accumulated experience doubles. This means that when inflation is factored out, costs should always decline. The decline is fast if growth is fast and slow if growth is slow.

There is no fundamental economic law that can predict the existence of the experience curve, even though it has been shown to apply to industries across the board. Its truth has been proven inductively, not deductively. And if it is true in service industries such as investment banking or legal advice, the lower costs are clearly not passed on to customers.

By itself, the curve is not particularly earth shattering. Even when BCG first expounded the relationship, it had been known since the second world war that it applied to direct labour costs. Less labour was needed for a given output depending on the experience of that labour. In aircraft production, for instance, labour input decreased by some 10-15% for every doubling of that labour's experience.

The strategic implications of the experience curve came closer to shattering earth. For if costs fell (fairly predictably) with experience, and if experience was closely related to market share (as it seemed it must be), then the competitor with the biggest market share was going to have a big cost advantage over its rivals. QED: being market leader is a valuable asset that a firm relinquishes at its peril.

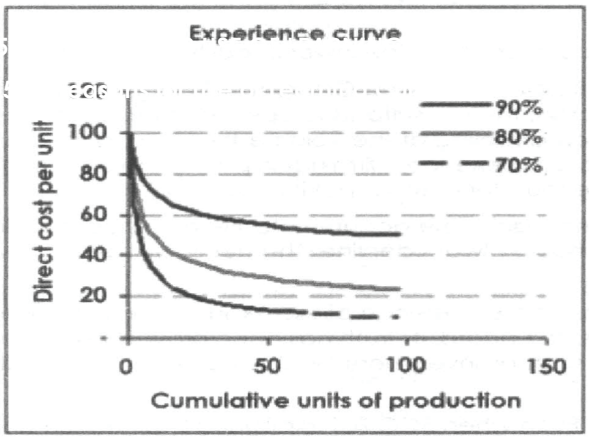
This was the logical underpinning of the idea of the growth share matrix. The experience curve justified allocating financial resources to those businesses (out of a firm's portfolio of businesses) that were (or were going to be) market leaders in their particular sectors. This, of course, implied starvation for those businesses that were not and never would be market leaders.

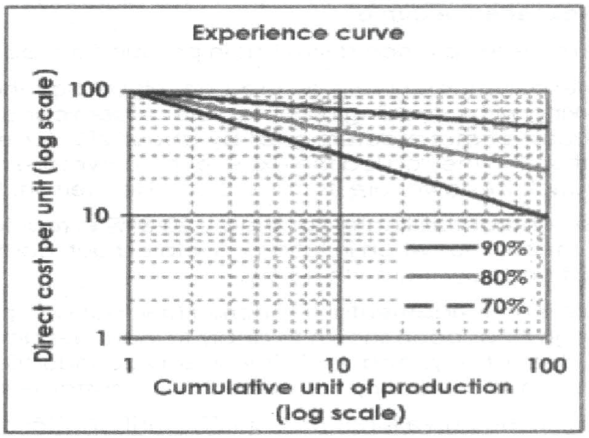
Over time, managers came to find the experience curve too imprecise to help them much with specific business plans. Inconveniently, different products had curves of a different slope and different sources of cost reduction. They did not, for instance, all have the same downward gradient as the semiconductor industry, where BCG had first identified the phenomenon. A study by the Rand Corporation found that "a doubling in the number of [nuclear] reactors [built by an architect-engineer] results in a 5% reduction in both construction time and capital cost".

Part of the explanation for this discrepancy was that different products provided different opportunities to gain

experience. Large products (such as nuclear reactors) are inherently bound to be produced in smaller volumes than small products (such as semiconductors). It is not easy for a firm to double the volume of production of something that it takes over five years to build, and whose total market may never be more than a few hundred units.

In theory, the experience curve should make it difficult for new entrants to challenge firms with a substantial market share. In practice, new firms enter old industries all the time, and before long many of them become major players in their markets. This is often because they have found ways of by passing what might seem like the remorseless inevitability of the curve and its slope. For example, experience can be gained not only first-hand, by actually doing the production and finding out for yourself, but also second-hand, by reading about it and by being trained by people who have firsthand experience. Furthermore, firms can leapfrog over the experience curve by means of innovation and invention. All the experience in the world in making black and white television sets is worthless if everyone wants to buy colour ones.





REASONS FOR USE OF LEARNING CURVE

There are a number of reasons why the experience curve and learning curve apply in most situations. They include:

Labour efficiency - Workers become physically more dexterous. They become mentally more confident and spend less time hesitating, learning, experimenting, or making mistakes. Over time they learn short-cuts and improvements. This applies to all employees and managers, not just those directly involved in production.

Standardization, specialization, and methods improvements - As processes, parts, and products become more standardized, efficiency tends to increase. When employees specialize in a limited set of tasks, they gain more experience with these tasks and operate at a faster rate.

Technology-Driven Learning - Automated production technology and information technology can introduce efficiencies as they are implemented and people learn how to use them efficiently and effectively.

Better use of equipment - as total production has increased; manufacturing equipment will have been more fully exploited, lowering fully accounted unit costs. In addition, purchase of more productive equipment can be justifiable.

Changes in the resource mix - As a company acquires experience, it can alter its mix of inputs and thereby become more efficient.

Product redesign - As the manufacturers and consumers have more experience with the product, they can usually find improvements. This filters through to the manufacturing process. A good example of this is Cadillac's testing of various "bells and whistles" specialty accessories. The ones that did not break became mass produced in other General Motors products; the ones that didn't stand the test of user "beatings" were discontinued, saving the car company money. As General Motors produced more cars, they learned how to best produce products that work for the least money.

Value chain effects - Experience curve effects are not limited to the company. Suppliers and distributors will also ride down the learning curve, making the whole value chain more efficient.

Network-building and use-cost reductions - As a product enters more widespread use, the consumer uses it

more efficiently because they're familiar with it. One fax machine in the world can do nothing, but if everyone has one, they build an increasingly efficient network of communications. Another example is email accounts; the more there are, the more efficient the network is, the lower everyone's cost per utility of using it.

Shared experience effects - Experience curve effects are reinforced when two or more products share a common activity or resource. Any efficiency learned from one product can be applied to the other products.

APPLICATION OF LEARNING CURVE

Application of Learning Curve

Learning curve may be applied to direct labor, materials and spoilage and defective work.

Direct Labour: Director Labour is the general application area of the learning curve since it is only people who are capable of learning. Learning presupposes a certain degrees of inexperience in the performance of an activity and as such, the learning curve is mainly applicable to new activities and new labour force, whether employed on new or old activities.

Materials - Materials respond to learning only in an indirect way under specific circumstances. 1 learning curve is applicable mainly to sub-contract or fabrication order placed outside or component purchased from suppliers. The cost of the sub-contract or the components purchased would normal contain an element of labour and the purchaser will expect that at least a part of the benefit of learning should be passed on to him in the form of reduced price for the repeat orders for the sub-contract components.

Spoilage and defective work: This is also an area for learning because with the acquirement of more skill and efficiency, losses on account of spoilage and defective production would decline.

On the other hand, the concept of learning curve may not be gainfully applicable in the following cases:

(i) Where machine work predominates and the operation time is limited by the speed and feed of the machine.

(ii) In old established industries where no substantial change takes place.

(iii) In industries which do not received repeat orders.

(iv) In small units where the quantity of production is small and costs are low.

Distinctive Features of Learning Curve Theory

(i) Learning curve is not a cost reduction technique. It is a naturally occurring human phenomenon.

(ii) It is a human characteristic that a person engaged in repetitive task will improve his performance over time.

(iii) In the initial stage of production, generally the workers do not have the confidence of completing the job successfully. When they produce a few units, they gain confidence. People learn from errors.

(iv) When the workers produce more and more units, they come to know the problems and their reasons. Now they are able to avoid the problems.

(v) The workers are able to find the new methods of doing the job; they are able to complete task in less time.

(vi) Better equipments and tools are developed.

(vii) Better product designs lead to increased efficiency.

Illustration 1:

The usual learning curve model is $Y = ax^b$ where

Y is the average time per unit for x units.

a is the time for first unit

x is the cumulative number of units

b is the learning coefficient and is

equal to log 0.8/log 2 = 0.322 of a learning rate of 80%

Given that a = 10 hours and learning rare 80%, you are required to Calculate:

(ι) The average time for 20 units.

(ii) The total time for 30 units.

(iii) The time for units 31 to 40.

Given that log 2 = 0.301, Antilog of 0.5811 = 3.812

log 3 = 0.4771,Antilog of 0.5244 = 3.345.

log 4 = 0.6021,Antilog of 0.4841 = 3.049.

Solution:

(i) $Y = AX^b$

$Y = 10(20)^{-0.322}$

Taking log on both sides

$Logy = log\ 10 + log\ 20^{(-0.322)}$

Logy = log 10 - (0.322) log 20

= 1 - (0.322) log 20

= 1-(0.322) x (1.3010)

= 1-0.41892 = 0.5811

Log y = 0.5811

Y = Anti log (0.5811) = 3.812 hrs (average time)

(ii) $Log\ y = log\ 10 + log\ 30^{(-0.322)}$

Log y= 1-(0.322)x (1.4771)

= 1 - (0.4756) = 0.5244

Y = anti log (0.5244) = 3.345 hrs (average time)

Total time = 3.345 x 30 = 100.35 hrs

(iii) $Log\ y = log\ 10 + log40^{(-0.322)}$

= l-(0.322) x (1.6021)

Log y = 0.4841

Y = anti log (0.4841) = 3.049hrs

Total time = 40 x 3.049 =121.96hrs

Time from 31 to 40 units = 121.96-(100.35) = 21.61hrs

Illustration 2:

The learning curve as a management accounting has now become or going to become an accepted tool in industry, for its applications are almost unlimited. When it is used correctly, it can lead to increase business and higher profits; when used without proper knowledge, it can lead to lost business and bankruptcy. State precisely:

(i) Your understanding of the learning curve:

(ii) The theory of learning curve;

(iii) The areas where learning curves may assist in management accounting; and

(iv) Illustrate the use of learning curves for calculating the expected average units cost of making. 4 machines (b) 8 machines

Using the data below:

Data:

Direct Labour need to make first machine	= 1,000 hrs.
Learning curve	= 90%
Direct Labour cost	= ₹ 15 per hour.

Direct materials cost = ₹ 1,50,000

Fixed cost for either size orders = ₹ 60,000.

Solution:

Statement showing computation of cost of making 4 machines & 8 machines:

No of Machines	Average time Hours	Labour cost (₹)	Material (₹)	Fixed cost (₹)	Total (₹)
1	1,000	15,000	1,50,000	60,000	2,25,000
2	900	13,500	1,50,000	30,000	1,93,500
4	810	12,150	1,50,000	15,000	1,77,150
8	729	10,935	1,50,000	7,500	1,68,435

Average cost of making 4 machines ₹1,77,150

Average cost of making 8 machines ₹ 1,68,435

Illustration 3:

Z.P.L.C experience difficulty in its budgeting process because it finds it necessary to qualify the learning effect as new products are introduced.

Substantial product changes occur and result in the need for retraining.

An order for 30 units of a new product has been received by Z.P.L.C So far, 14 have been completed; the first unit required 40 direct labour hours and a total of 240 direct labour has been recorded for the 14 units. The production manager expects an 80% learning effect for this type of work.

The company use standard absorption costing. The direct costs attributed to the centre in which the unit is manufactured and its direct materials costs are as follows:

	(₹)
Direct material	30.00 per unit.
Direct Labour	6.00 per hour.
Variable overhead	0.50 per direct labour hour.
Fixed overhead	6,000 per four-week operating period.

There are ten direct employees working a five-day week, eight hours per day. Personal and other downtime allowances account for 25% of total available time.

The company usually quotes a four-week delivery period for orders.

You are required to:

(ι) Determine whether the assumption of an 80% learning effect is a reasonable one in this case, by using the standard formula $y = ax^b$

Where Y = the cumulative average direct labour time per unit (productivity)

a = the average labour time per unit for the first batch.

x = the cumulative number of batches produced.

b = the index of learning.

(ii) Calculate the number of direct labour hours likely to be required for an expected second order of 20 units.

(iii) Use the cost data given to produce an estimated product cost for the initial order, examine the problems which may be created for budgeting by the presence of the learning effect.

Solution:

(i) Total time taken to produce 14 units

$Y = ax^6$

$Y = 40(14)^{-0.322}$

$= 17.14$

Total time = 17.14 × 14 = 239.96 = 240 hours

It is true that learning ratio 80% is effective.

(ii) 30 units

$Y = 40\ (30)^{-0.322}$ = 13.380 hours (Average time)

50 units

$Y = 40\ (50)^{-0.322}$ = 11.35 hours (Average time)

Total time for 30 units = 13.38 × 30 = 401.4 hours

Total time for 50 units = 11.35 × 50 = 567.5 hours

Time taken for 20 units from 31 to 50 units (567.5 - 401.4) = 166.1 hours

(iii)

Man hours = 1 0 × 8 × 5 × 4	1,600
(-) down time	400
	1,200

Fixed Cost per hour = 6,000/1,200 = ₹ 5

Computation of total cost for the initial order

	(₹)
Material (30 × 30)	900.0
Labour (401.4× 6)	2408.4
Variable Overheads (0.5× 401.4)	200.7
Fixed Overheads (5 × 401.4)	2007.0
	5516.1

Illustration 4:

A firm received an order to make and supply eight units of standard product which involves intricate labour operations. The first unit was made in 10 hours. It is understood that this type of operations is subject to 80% learning rate. The workers are getting a wages rate of ₹ 12 per hour.

(i) What is the total time and labour cost required to execute the above order?

(ii) If a repeat order of 24 units is also received from the same customer, what is the labour cost necessary for the second order?

Solution:

80% Learning Curve results are given below:

Production (Units)	Cumulative Average Time (hours)	Total Time (hours)
1	10	10
2	8	16
4	6.4	25.6
8	5.12	40.96
16	4.096	65.54
32	3.2768	104.86

Labour time required for first eight units = 40.96 hours

Labour cost required for 8 units = 40.96 hours × ₹ 12/hr = ₹ 491.52

Labour time for 32 units = 104.86 hours

Labour time for first eight units = 40.96 hours

Labour time required for 2nd order for 24 units = 63.90 hours

Labour cost for 24 units = 63.90 hours × ₹ 12/hr = ₹ 766.80

Illustration 5:

The learning curve as a management accounting has now become or going to become an accepted tool in industry, for its applications are almost unlimited. When it is used correctly, it can lead to increase business and higher profits; when used without proper knowledge, it can lead to lost business and bankruptcy. State precisely:

(ι) Your understanding of the learning curve:

(ιι) The theory of learning curve;

(ιιι) The areas where learning curves may assist in management accounting; and

(ιϖ) Illustrate the use of learning curves for calculating the expected average units cost of making, (a) 4 machines (b) 8 machines using the data below:

Data:

Direct Labour need to make first machine = 1000 hrs.

Learning curve = 90%

Direct Labour cost = ₹ 15/- per hour.

Direct materials cost = ₹ 1,50,000

Fixed cost for either size orders = ₹ 60,000.

Solution:

Statement showing computation of cost of making 4 machines & 8 machines:

No. of machines	Average time	Labour cost	Material	Fixed cost	Total
1	1000	15000	150000	60000	225000
2	900	13500	150000	30000	193500
4	810	12150	150000	15000	177150
8	729	10935	150000	7500	168435

Average cost of making 4 machines ₹1,77,150

Average cost of making 8 machines ₹ 1,68,435

1. Discuss the applicability of Learning Curve in the following situation;

   (i) A set of very experienced people feed data into the computer for processing inventory records in the factory. The manager wishes to apply 80% learning rate on data entry and calculation of inventory.

   (ii) A new type of machinery is to be installed in the factory. This is patented process and the output may take a year for full fledged production. The factory manager wants to use a learning rate on the workers at the new machine.

   (iii) An operation uses contract labour. The contractor shifts people among various jobs once in two days. The labour force performs one task in 3 days. The manager wants to apply an average learning rate of these workers.

11 PROFITABILITY ANALYSIS

INTRODUCTION:

Business is conducted primarily to earn profits. The amount of profit earned measures the efficiency of a business. The greater the volume of profit, the higher is the efficiency of the concern. The profit of a business may be measured and analyzed by studying the profitability of investments attained by the business.

MEANING AND DEFINITION OF PROFIBILITY :

The word 'profitability' is composed of two words, namely; profit and ability. The term profit has already been discussed at length in detail. The term ability indicates the power of a firm to earn profits. The ability of an enterprise also denotes its earning power or operating performance. Also, that the business ability points towards the financial and operational ability of the business. So, on this basis profitability may be defined as -the ability of a given instrument to earn a return from its use"' Weston and Brigham defines profitability as "the net surplus of a large number of policies and decisions.".

Profit being an absolute figure fails to indicate the adequacy of income or changes in efficiency resulting from financial and operational performance of an enterprise. Much difficulty and confusion comes home while interpreting the absolute figures of profit in case of historical or inter-firm comparisons due to variation in the size of investment or volume of sales etc. Such problems are handled by relating figures of profit either with the volume of sales or with the level of investment. A quantitative relationship is thereof established either in the form of ratios or percentages. Such ratios are names as profitability ratios. Thus, profitability may be regarded as a relative term measurable in terms of profit and its relation with other elements that can directly influence the profit.

No doubt, profit and profitability are closely related and mutually interdependent, yet they are two different concepts. "The accounting concept of profit measures what have been accumulated, the analytical concept of profitability is concerned with future accumulation of wealth."[3] Profit of an enterprise, reports about the financial and operational efficiency of the business. Whereas, profitability interprets the term profit in relation to other elements likely to affect these profits in order to help in decision-making.

Profit is regarded as an absolute connotation as against profitability, which is regarded as a relative concept. Where profit is the residual income left after meeting all manufacturing, administrative expenses; profitability is the profit making ability of an enterprise. The profit figure indicates the amount of earning of a business during a special period. While, profitability denotes whether these profits are constant or improved or deteriorated, how and to what extent they can be improved. profit in two separate business concerns may be identical, yet, at many times, it usually happens that their profitability varies when measured in terms of size of investment* It has been aptly remarked that the role played by profits and profitability in a business enterprises is identical to the function carried out by blood and pulse in the human body.

Profitability is the ability to earn profit from all the activities of an enterprise. It indicates how well management of an enterprise generates earnings by using the resources at its disposal. In the other words the ability to earn profit e.g. profitability, it is composed of two words profit and ability. The word profit represents the absolute figure of profit but an absolute figure alone does not give an exact ideas of the adequacy or otherwise of increase or change in performance as shown in the financial statement of the enterprise. The word 'ability' reflects the power of an enterprise to earn profits, it is called earning performance. Earnings are an essential requirement to continue the business. So we can say that a healthy enterprise is that which has good profitability. According to hermenson Edward and salmonson 'profitability is the relationship of income to some balance sheet measure which indicates the relative ability to earn income on assets employed.

CONCEPT OF PROFITABILITY:

1. Accounting Profitability

Profitability is a measure of evaluating the overall efficiency of the business. The best possible course for evaluation of business efficiency may be input-output analysis. Profitability can be measured by relating output as a proportion of input or matching it with the results of other firms of the same industry or results attained in the different periods of operations. Profitability of a firm can be evaluated by comparing the amount of capital employed i.e. the input with income earned i.e. the output. This is popularly known as return on investment or return on capital employed. It is regarded as the overall profitability ratio and has two components; net profit ratio and turnover ratio. That is:

Return on Investment = Net Profit Ratio x Turnover Ratio

Or, Return on Investment = Operating × Sales

Or, Return Investment = $\frac{\text{Sales Operating Profit}}{\text{Capital Employed}}$ Capital Employed

This method is increasingly accepted as an indicator of performance and capability. This is the reason for viewing operational and financial performance in relation to the scale of resources of funds required in production. That is, "a given amount of profit return should be evaluated in terms of the percentage profit return on the investment of funds."

Moreover, "the return on capital used depicts the effectiveness of all the operating decisions from the routine to the critical, made by the management at all levels of the organization from shop foreman to President.

2. Social Profitability

Along with the economic objective of earning profits, a business is also required to perform a large number of social objectives. Besides providing better quality of goods and services, it provides big employment opportunities to the people, better condition of work, fulfill community needs, conserves resources etc. C. Mean Cardiner rightly observed, "The darkness of avarice has been dispelled by the light of a new kind of social responsibility."

Social objectives may prove profitable as well as expensive lo a concern. As some objectives aids in enhancing profitability by attracting customers like in case of providing quality goods. Whilst other may be counteractive such as elimination of pollution may cost the company and reduce its profitability, but it creates social profitability.

In other words of Earnest Dale, these social objectives "appear lo urge the executive to assume an infinitely broad-gauge burden of responsibilities to all the various public with whom he clears." That makes it an obligation on the part of the company to disclose its financial, marketing, personnel and social objectives in a simple and concise form to all the members of the concern so that they can judge the influence of these objectives on their jobs.

3. Value Added Profitability

Wealth generation is essential for every enterprise. Value added profitability indicates the wealth generated (net value earned) as a result of manufacturing process during a specified period. Wealth generation is the very essence for survival or growth of a business. An enterprise may survive without making profit but would cease to do so without adding value. "The enterprise, not making profit, is bound to become sick but not adding value may cause its death over a period of lime."

Profit forms a part of value added. Thus, value added is a broader concept. "Value added at particular level of operating capacity and claims should be determined as value added can expose the efficiency and inefficiency of a business. The concept of value added can be related to the concept of social profitability of an enterprise. The investment of an enterprise comprises of the investment of shareholders, debenture holders, creditors, financial institutions etc. If an enterprise fails to generate growth or add anything as value added, it would simply mean that the enterprise is misusing public funds. This concept represents the wealth distribution in a proper manner besides suggesting how productivity can be increased when reducing the consumption of resources produces same or better outputs.

4.Measurement of Profitability

The measurement of profitability for a concern is as important as the earning of profits. The importance of measuring profitability has been stated by Hingorani, Ramanathan rand Grewal, "A measure of profitability is the overall measure of efficiency."^Since, profitability is the outcome of many business activities. Therefore, its measurement is a multistage concept. As stated before profitability is a relative concept based on profits.

But profits alone cannot express the concept of profitability. Thus, there arises a need to established relationship between profit and other variables. Some of the well-known techniques of measurement of profitability are discussed below: -

Accounting Profitability

The most common course of action adopted by a management in measuring profitability is that several relationships between investment figures and its related income figures are established. Profitability of a concern depends mainly up to two factors; the rapidity of turnover of capital employed and the operating profit margin. Profitability is the resultant figure obtained by the product of these two factors. Hence, profitability can be maximized by maximizing each i.e. a better profitability level can be achieved by improving the net profit ratio and turnover ratio of an enterprise. The net profit ratio reveals the margin made in each sale in terms of percentage and the turnover ratio states the rotation of the capital for affecting the sales proceeds. In technical terms the combination of profitability with operating profit margin and turnover is known as the '*triangular relationship*'. The significance of this relationship lies not only in the fact that it can be utilized as a tool of analysis but also because that it can be directly calculated from the earning and investment data. –It *is useful in describing the two basic* Forces bearing upon ultimate results and therefore, establishes the area of business operation which must be properly controlled, if desired results are to be realized."™ The triangular relationship can be expressed in the forms of equation as follows:

$$\text{Turnover} = \frac{\text{Sales}}{\text{Operating Assets}}$$

$$\text{And, Profit Margin} = \frac{\text{Net Operating Profit}}{\text{Sales}}$$

$$\text{So, Profitability} = \frac{\text{Net Operating Profit}}{\text{Operating Assets}}$$

Here, the term operating assets describe the capital employed in fixed assets and current assets. While, operating profit is the income earned from employing this capital in the business. Where on one side, increasing the net profit and turnover ratios can increase profitability, there on the other side profitability can also be increased by reducing investment in fixed and current assets and increasing profit margin. Certain ways for reducing the investment in fixed assets are suggested below:

Disposing the idle plants and equipments.

(A) Closing down the unprofitable departments and transferring the assets of such department to profitable ones.

(B) Selling or leasing back the premise, which is not required.

(C) Selling or disposing the tools and equipments which are either in worn out condition or have become obsolete.

(D) The variations arising in measurement of profit due to existence of different methods of evaluating the assets must be duly recognized. Eg. Both straight- line method and diminishing value method of charging depreciations would differently influence the net margin. Thus, for such reasons a company must attempt for selecting more profitable method. Some points of suggestions for decreasing current assets Investment is given below:

- Purchasing good quality raw material at least possible prices by effective quality control and cost control techniques.
- Improving the equipments and methods of handling materials.
- By reducing the time of operation cycle and time lag between two operations.
- By bringing about reduction in the level of inventories with the help of good inventory management system.
- Curtailing the investment in accounts receivables by adopting conservative credit and collection policy.
- By maintaining just adequate cash position and investing the surplus cash in the marketable securities.
- By maximum utilization of the available resources and minimizing wastage. Adopting any of the three ways stated below can increase the profit margin:

(1) By increasing amount of sales. This can be made possible either by increasing selling price per unit or by enhancing sale of the product yielding high favourable returns or by minimizing the production unit incurring losses and utilizing that capacity in production of product yielding profit or by using the waste or scarp as raw material for producing other articles. Operating expenses in such cases must not be left ignored for any such increase would decrease the sales amount directly.

(2) By reducing the cost of sales. Cost of sales comprises of elements of operating expenses. Operating expenses can be effectively and efficiently controlled through cost control and cost reduction techniques. As a matter of fact while bringing about reduction in operating expenses an enterprise can escape decrease in sales.

(3) By increasing sales and reducing operating expenses simultaneously. As both these factors hold equal importance in raising profit margin, the improvement in any one factor while ignoring the other keep the return on investment at the same level. On the other hand, if excellence is attained in respect of one aspect while other remains unsatisfactory, it will lead to downfall in return on investment. Therefore, it is vital to maintain parity between the two factors.

Value Added Profitability

Traditionally, the operational and financial efficiency of an organization are evaluated in terms of profit realized during an accounting Period. Profit analysis conducted solely and wholly on the basis of profit is regarded as uni-directional. Moreover, profitability analysis based on 'return on investment' which is two dimensional being resultant of profit margin and assets turnover is regarded as microscopic because it fails to expose the generation of earnings and its allocation to various parties. So, the need arises for assessing the profitability of a concern on the basis of profit, and absolute terms, on the basis of return on investment in relative terms and also on the basis of value added by the concern towards the gross national product. Thus, many companies are now introducing and stressing upon the importance of the value added statement. Acknowledging the vitality of measuring value- added profitability, a large number of companies in western countries are presenting the value-added statement in their annual reports. But, this technique is at its infancy in India and is yet to be established. The presentation of value-added statement in annual reports is neither statutory nor deemed to be an obligation for companies in our country. Nevertheless, some companies have recognized its importance and have given due privilege to value-added statement by including it in their annual reports.

Value added is an excess of turnover and income from securities over and above the cost of availing materials and services the term '*turnover*' here, refers to the gross sale of goods including duties, sale tax but excluding the amount of returns, goods used for self- consumption, commission, rebates and discounts etc. The '*income from securities*' means the income in the form of dividends from subsidiary companies, rent, compensation and the like. The term '*cost of availing materials*' includes the cost of materials consumed the cost of merchanting of materials consumed in addition to the cost of stores and spare parts consumed during the process of manufacture. The term '*cost of services*' comprises of the cost of procuring services, power, fuel, repairs and maintenance, back commission, insurance premium, advertising and publicity, postage and telephones, printing, auditing, legal charges, traveling expenses etc. The employee's cost (like salaries and wages), depreciation and excise duty are not included in the cost of availing materials and services. Profit and loss account figures are the base for computation of the value added. There are certain items appearing on the debit and credit side of profit and loss account of an enterprise which is non-value added statement items like on credit side appears profit on sale of investment and fixed assets and on the debit side, provision for bad and doubtful debts, provision for taxation, non-operating expenses like donations etc.

According to one school of thought, the turnover plus income from services over the cost of bought-in of materials and services is termed as '*gross value added*'. The annual charge of depreciation on the remainder is called '*net valued added*'. Whilst another school of thought is of the opinion that the excess of turnover plus the income from services over cost of bought-in of materials and services is termed as '*value added*' and the annual charge of depreciation is known as an application of value added available to the owners of the enterprise in the form of retained earnings. For the purpose of this study the second school of thought is favoured.

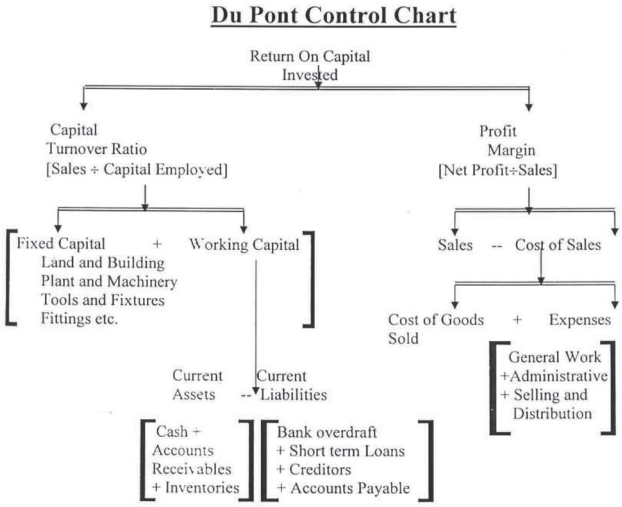
There are two methods of calculating percentage of value added; *the subtractive and the additive method.* Whereby, value added can be obtained as sales less bought-in costs or can be expressed as profit before tax plus employees cost, depreciation and interest. The application of value added belongs largely to four parties mentioned below: -

- **Workers:** Workers contribute their skill, knowledge, capacity and efficiency. So, the share is entitled among them in the form of wages and salaries, bonus, contribution to provident funds, gratuity, welfare expenses, director's remuneration etc.
- **Government:** A share in value added is to be given to the government for it provides most of the infra-structure facilities to an enterprise in the form of income tax, excise tax, sales tax, octrio duty, customs duty, rates and taxes etc. But the amount granted by the government to the enterprise in the form of export incentives, tax credits, subsidies, refunds of any duty etc. are to be deducted from this share.

- **Providers of Capital:** It includes creditors and financial institutions who provides for working capital and other long-term requirements. Their share is paid off in the form of dividends and interest.
- **Shareholders:** They are the real owners of the company. As the matter of policy the profits are to be ploughed back as retained earning which belong to them. But a share in value added is paid to them in the form of dividends which is required to be separately mentioned under the head 'reinvested in business.' Figure 4.1 displays allocation of value added to the various interested parties of steel development finance Industry by a simple and effective way of pie diagram for the period of 8 years

THE DU-PONT CONTROL CHART:

E.I. Du Pont De Nemours and company Welmington, U.S.A. originally develops this chart. It was first put in operation in 1921, when Irenee Du Pont was the president of the company. This system is considered to be an operationally useful tool for evolution of inter- industry, inter-corporation and inter-product profitability. The mechanics of Du Pont chart system of control utilizes the ratio inter-relationship and develops a series of chart to derive the attention of management to desirable and undesirable trends of the concern. Once a company succeeds in developing reasonable standards of performance regarding the various ratios, the performance changes can be easily judged with the help of such a system. The main objective of Du Pont system is to isolate the elements entering into the final figure in order to appraise the affect of individual factor on the performance.



The first tier i.e. capital turnover ratio is obtained by dividing sales by capital employed. Capital employed is bifurcated as fixed capital /consisting of land and building, plant machinery, tools, fixtures, fittings etc.) and working capital (which is computed by deducting current liabilities from current assets). Current liabilities are stated in the form of bank overdraft, short-term loans, creditors, accounts payable etc. Current assets are sum total of cash balance, accounts receivables and inventories. In the second tier, the sequence begins with the profit margin given by profit divided by sales. Where, profit is expressed as sales less cost of sales. Further, cost of sales is the aggregate sum of cost of goods sold and expenses like general work expenses, administrative expenses, and selling and distribution expenses.

The two-tier approach concentrates attention on the separate forms contributing to profit. Improvement can be accomplished either through more effective use of available resources i.e. capital, measured by turnover sequence or by a better relationship between sales and expenses, measured by profit margin sequence. *"For providing standards of evaluation, calculations are made on the ratios of return on investment, assets turnover and profit margins for comparable companies"* James C. Van Home correctly remarks, *"Profitability ratios are of two types; those showing profitability in relation to sales, and those showing profitability in relation to investment'™.* He further points out, *"With all the profitability ratios, comparison of a company with similar companies are extremely valuable. Only by comparison are we able to judge whether the profitability of a particular company is good or bad and why. Absolute figures give some insight, but it is relative performance which is most important."™* This statement clearly emphasis the importance of profitability.

12 BALANCE SCORE CARD

This chapter elaborates the concepts of Balanced Scorecard, various components of BSC and its applications. The emergence BSC and its evolution into a strategy management system have been discussed. Available literatures, both supportive and critical of BSC have been referred to for this discussion. Balanced Scorecard implementation in the public sector context has also been referred. Further, conceptualisation about the development and implementation of BSC through cascading effect is arrived at. The author has also presented a definition of 'successful implementation' of BSC based on the available literature.

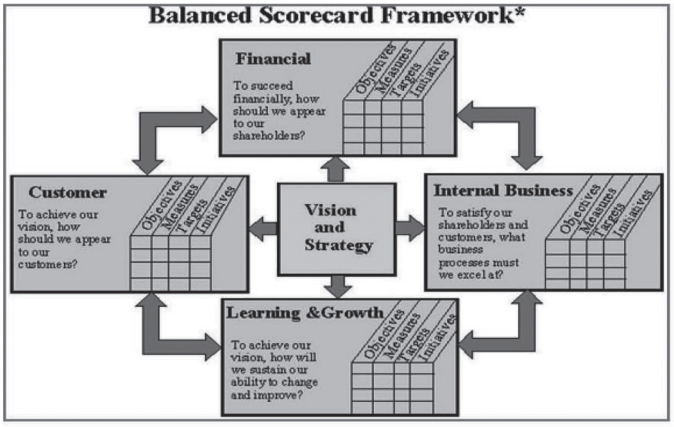
What is Balanced Scorecard?

Balanced Scorecard is a strategy management system that helps managers to translate organisation strategy into operational objectives and implement it. BSC framework looks at the strategy from four different perspectives i.e. financial, customer, internal business processes and learning and growth. Thus, it brings in the necessary clarity to strategy. Further, implementation of BSC ensures that strategy gets communicated to all the employees suitably to facilitate implementation by them. Measuring organisational performance through BSC reviews remain integral to BSC concept. Based on the learning from these reviews, strategy gets updated. Thus, the four important steps in BSC designing and implementation include 1) translating vision into operational objectives, 2) communicating the vision and linking it to the individual performance, 3) planning and adjusting the strategy based on feedback and 4) learning. The concept of Balanced Scorecard was explained by Kaplan and Norton (1996) as: *Balanced Scorecard complements financial measures of past performance with measures of the drivers of future performance. The objectives and measures of the scorecard are derived from an organisation's vision and strategy. The objectives and measures view organisational performance from four perspectives: financial, customer, internal business processes, and learning and growth. These four perspectives provide the framework for the balanced scorecard*. Kaplan and Norton further added that, *Corporate executives can now measure how their business units create value for current and future customers and how they must enhance internal capabilities and the investment in people, systems, and procedures necessary to improve future performance*.

BSC, thus, strikes a balance between long term and short term objectives, financial outcomes and performance drivers for the same, and introduces a continuous process of learning and adaption to modified strategies. The strategy is broken down into critical operational strategic objectives considering the customer value proposition (Kaplan and Norton, 1996) and the desired financial results. The performance drivers or the lead objectives to these outcome objectives in the financial and customer perspectives are then identified and placed in the internal business processes and learning and growth perspectives forming a causal relationship. The drawing that shows these objectives placed in different perspectives, linked with arrows depicting causal relationship is known as strategy map (Kaplan and Norton, 2004).

A balance is maintained between the financial and non-financial, short term and long term, and the lead and lag objectives. Each of these objectives are well defined to ensure common understanding of the terms, Appropriate measures, targets and initiatives are identified with respect to each objective. A typical format of balanced scorecard is given in Figure 2.1.

The Balanced Scorecard Framework



Source: Reprinted with permission from Kaplan, R.S. and Norton, D.P. 1996. 'Using the Balanced Scorecard as a strategic Management System,' *Harvard Business Review,* Januray-February.

The measures on the balanced scorecard ensure a balance between external measures for shareholders and customers, and internal measures of critical business processes, innovation and learning and growth. It strikes a balance between the outcome measures of past performance (lag indicators); the measures that drive future performance (lead indicators), and also between clearly quantifiable and somewhat subjective measures (Kaplan and Norton, 1996). BSC introduced the idea of measuring the drivers of performance, i.e. the lead indicators while retaining the measures of financial performance, i.e. the lag indicators of performance (Brown, 2000). Measures in each of these perspectives are interlinked such that a change in the leading measure results in a change in the lagging measure (Kaplan and Norton, 2001).

Emergence and Evolution of BSC

In the late 1980s, organisations started realising that, in order to assess the overall health and performance of the organisation, it was important to measure and manage nonfinancial measures also in addition to the traditional financial measures such as profits, share values, sales volumes etc. Traditional financial measures are usually the lag indicators of the business performance and tell the story of the past. They do not provide any insight into the intangible assets and capabilities that need to be developed in order to be able to achieve the desired financial results. For example, frontline workers in a manufacturing set up are far removed from these financial measures and have no idea about how their day to day work translates into financial results. Thus, financial measures fail in assessing the intangible value possessed by the organisation or the value it can create. They can also fail the knowledge based strategies by treating human capital as expense items; whereas it is widely recognised that human capital is actually the most important component of the value creation chain. Balanced Scorecard ws developed in response to this need (Kaplan & Norton 1992; 1996; 2001). BSC introduced the idea of measuring the drivers of performance, while retaining the measures of financial performance (Brown, 2000).

The term 'Balanced Scorecard' was coined by Art Schneiderman in 1987. But, till the early 1990's the system was understood to be a mix of financial and non-financial measures limited to 15-20 numbers which were clustered in four perspectives. BSC became a popular term when Kaplan and Norton who worked extensively on scorecards published reports of several BSC implementation successes. However, there were no clear definitions of BSC. Understanding about these 1st generation scorecards was deduced from various writings of Kaplan and Norton. In these scorecards, there were design challenges and it was not clear as to how measures were to be selected. The measures were to be related to specific strategic goals, but it was not clear as to how they must be decided.

Kaplan and Norton suggested two innovations in BSC to overcome these design weaknesses- 1) strategic objectives and 2) causal relationship. These scorecards were known as 2nd generation scorecards. In these scorecards, the measures were chosen to relate to specific strategic objectives. The design aimed at having 20-25 strategic objectives, each objective being associated with one or more measures, and spread across four perspectives. Starting from the learning and growth perspective and leading to the financial, the link of causality was shown between the strategic objectives across perspectives from drivers of performance to the outcomes. A visual representation of the Strategic objectives with causal linkages among strategic objectives in four perspectives, known as strategy map diagram, came into existence in the 2nd generation scorecards. Though 2nd generation scorecards were significant improvement over the first generation scorecards, organisations implementing BSC were facing design challenges especially with respect to measure selections, target setting and cascading. It was assumed that mission/vision or the strategy plan based on which BSC was designed had a common understanding and interpretation by the management team, though there was no design component or specific activity to ensure this. Also, there was no clarity about who makes the selection of strategic objectives.

This triggered the development of 'Destination Statement'.

The 3rd generation scorecards were characterised by destination statements which were clear statements about what the organisation was trying to achieve in a specified time frame. The whole target setting process used it as a reference point. Commonly agreed destination statement enhanced the ownership and utility of BSC. While the focus of the 1st generation scorecards was on measure selection (filtering), the focus of 2nd generation scorecard was on how measures are grouped (Clustering) (Cobbold and Lawrie, 2002); 3rd generation scorecards focused on the shared understanding of the destination statement.

Though, initially, BSC emerged as a performance management system, over a period of time it has come to be known as a strategy management system, with its ultimate aim being the achievement of long term financial performance. Balanced scorecard is seen as a strategic management system enabling business leaders to meet the challenge of strategy execution.

Basic Components and Characteristics of BSC

There are six basic components of BSC. They are perspectives, themes, objectives, measures, targets, and initiatives.

Perspectives: There are four standard perspectives as suggested by Kaplan and Norton. These are financial, customer, internal business process, and learning and growth. However, organisations can choose any number of perspectives as may suit their need of sufficiently measuring the present performance and the drivers of future performance (Kaplan, 1996). The number would depend on how the stakeholders' expectations are being represented and the manner in which the organisation would decipher their strategy.

All relevant factors for strategy execution are accounted for in these perspectives, thus creating a balance between the short term and long term objectives as well as linking the desired outcomes and the performance drivers for those outcomes. Thus, perspectives form the basic architecture of BSC.

Themes: Themes are inherent in the strategy and provide an insight into how an organisation would carry out its mission. There are usually three to four basic themes consisting of a collection of objectives across perspectives which enable execution of the theme.

Objectives: They highlight critical factors to the success of the organisation which must certainly be achieved.

Measures: What gets measured gets achieved. Measures help organisation determine its success in executing strategy. The two fundamental purposes served by measures are organisational motivation and objective evaluation of the strategy as well as strategic learning.

Targets: Targets help define the level of performance or the rate of improvement that is needed.

Initiatives: These are key action programms that are required to achieve the objectives. The distinguishing characteristic of BSC which is not found in other management control systems is the assumption of the cause-and-effect relationships between measures across the four perspectives. Strategy is understood in terms of a series of linked hypothesis that describe cause-and-effect relationships. For example, it can be hypothesised that 'employee satisfaction' shall lead to 'employee retention' and 'employee productivity'.

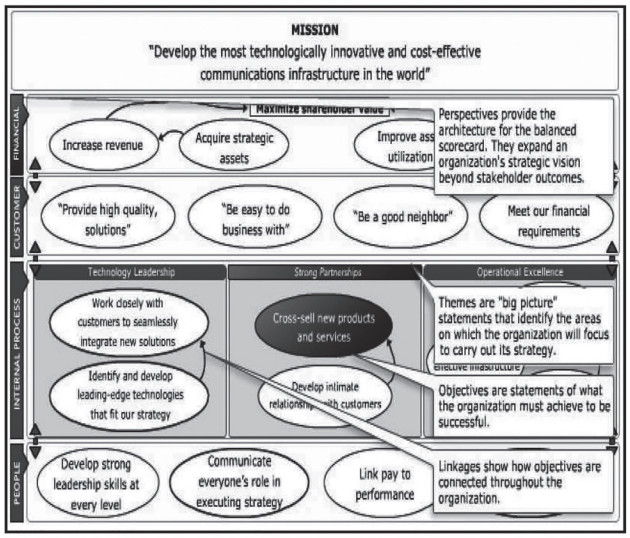
Accordingly, when there is improvement in 'employee satisfaction' the other two 'effect' parameters shall also show improvements. If they don't, the hypothesis can be considered invalid. Thus, measurements in BSC provide an ongoing account of the projected causeand- effect relationships across perspectives which are essential for making informed decisions. The causal relationships across four perspectives help predict the financial performance based on the indication from non-financial measures (Kaplan and Norton, 1996).

BSC constitutes a good balance between financial and non-financial measures. Objectives across the four perspectives show balance between the external measures usually present in the financial and customer perspectives and the internal measures that are in the other two perspectives of internal business process and learning and growth. It also indicates a balance between the lag indicators of past performance and the lead indicators that drive future performance.

Strategy Map

A pictorial representation of objectives across four perspectives of BSC, with the connectors showing the cause and effect relationship between them is known as strategy map. Figure 2.2 gives an example of a strategy map and defines the components of Balanced Scorecard.

Strategy Map



Source: Adapted with permission from, Balanced Scorecard Collaborative, Inc., 2008. Course

***Manual of BSC*, bscol.com**

A Strategy map can communicate organisation strategy in just one page and provide a framework for testing assumptions about the strategy. It can be built by first listing perspectives, followed by defining themes, creating objectives and building causal linkages among objectives. Financial perspective shows how strategy balances the long term and short term objectives. Customer perspective highlights the differentiated value proposition the organisation intends to offer to the target customer. It communicates what the organisation intends to do better or different from its competitors.

The perspective of internal processes accomplishes two fundamental components of strategy i.e. 'to produce and deliver the value proposition for customers, and they improve processes and reduce costs for the productivity component in financial perspective' (Kaplan and Norton, 2004). Learning and growth perspective aligns the intangible assets with strategy.

Criticism of Causal Relationship

This causal relationship and balance, the very essence of BSC has however, been challenged by some of the academicians like Norreklit (2000) and Brignall (2002). According to Norreklit (2000) causal relationship across perspectives cannot be proven on a generic level. Norreklit also refutes the claim that BSC is a strategic control model. As it does not monitor the competition or technological developments it does not consider any risk from strategic uncertainties. She highlights those other control systems such as the Skandia model which also suggests that financial measures are like the roof of the house which itself is result of activities undertaken at lower levels. Hence, theoretically, BSC is similar and not superior to other recent management control systems even though it may appear that BSC is a revolutionary tool combining the financial measures with nonfinancial measures. Norreklit (2000) however argues that General Electric used nonfinancial

measures as early as in the 1950s and all recently developed performance management tools seem to have a combination of financial and non-financial measures. Besides, all these tools have performance indicators connected to strategy thereby being an integrated system. In defense of the cause-and-effect relationship, Bukh et al, (2001), says that the causal relationships in BSC should not be perceived as generic, but specific to the organisation. These are determined by the actual situation and the relevant time dimension between measures. These relationships, in any case, are beliefs and assumptions and not established certainties. By following the logic of cause-and–effect the management of any organisation can come up with its unique strategy and establish measures believed to lead to the desired results.

Applications of BSC

BSC steers the entire organisation to work towards a shared vision in addition to providing necessary clarity, guidance and control through regular BSC reviews. According to Kaplan and Norton (1996), the balanced scorecard can be used to:

1. Clarify and gain consensus about strategy,
2. Communicate strategy throughout the organisation,

3. Align departmental and personal goals to the strategy,
4. Link strategic objectives to long-term targets and annual budgets,
5. Identify and align strategic initiatives,
6. Perform periodic and systematic strategic reviews, and
7. Obtain feedback to learn about and improve strategy.

Some of the ways in which organisations have been using BSC are discussed in the following, subtitled paragraphs.

BSC as a Management Control and Performance Management System

Management control is defined as 'systems providing information that is intended to be useful to managers in performing their jobs and to assist organisations in developing and maintaining viable patterns of behavior' (Otley, 1999:364). BSC, as a control and performance measurement system, 'provides executives with a comprehensive framework that translates a company's strategic objectives into a coherent set of performance measures' (Kaplan and Norton, 1993). Available literature has academic studies both in support of and challenging claims of BSC leading to improvement in performance.

As regards the usage of BSC, Ahn (2001) studied a large automation product supplier in Switzerland and concluded out that implementing BSC not only enhances performance but also aids in communicating strategy, planning and budgeting, strategy oriented specific initiatives. Thus, BSC gets integrated in to the company's control system. Ahn further recommended that 'Balanced Scorecard should replace – not complement –a company's current performance measurement system.' In a quasi-experimental study of two American Banks, Davis and Albright (2000) found that performance of banking organisations implementing BSC far exceeded the performance of banking organisations that had not implemented BSC. A similar quasiexperimental study by Chi and Hung (2011), re-affirmed that companies that implemented BSC performed commendably well. In direct rebuttal to these, another quasi- experimental study by Neely (2008) indicated that performance impact of BSC was open to question. Performance data for up to three financial years was collected from two divisions of an electrical wholesale business chain in the UK and compared. The business units had similar set-ups, but one of these had implemented BSC and the other had not. The findings indicated similar improvements in sales and gross profits of both the units.

BSC as a Strategy Management System

As mentioned earlier the word 'Strategy' has a military origin. In business context, strategy is defined as the direction and scope of an organisation over the long-term; which achieves advantage for the organisation through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfil stakeholder expectations (Hamel & Prahalad, 1994). The process of strategy development has to consider both the external and internal resources. In the ultimate analysis, the benefits of a good strategy are evident only if it gets executed as designed and in time. Strategy execution is a big challenge for the leadership in any organisation (Porter, 1991).

Executing a strategy is an art form that is entirely different from crafting a good one. Execution is the key to successful strategy implementation. Several barriers that impede strategy implementation have been categorised into four categories as shown in Figure 2.3. To view the barriers in perspective, it must be pointed out only 5 percent of the workforce understands organisational vision and strategy (vision barrier). Only 25 percent of managers have incentives linked to strategy (people barrier); 60 percent of organisations don't link budgets to strategy (resource barrier) and 85 percent of management teams spend less than one hour discussing strategy (management barrier). Successful implementation of balanced scorecard necessitates overcoming all these barriers.

Barriers to Strategy Implementation

As a strategy implementation tool, BSC attempts to address all four barriers through an integrated approach and helps organisations to define the value of non-tangible assets. The areas of concern in which the organisation needs to improve become evident and can be worked upon. Changes get initiated and actions aligned with strategic objectives, thus gradually bridging the performance gap. The process of strategy implementation improves results immensely, thereby contributing to overall performance. According to Becker andHuselid (2006) 35 percent improvement in quality of strategy implementation is associated with 30 percent improvement in shareholder value.

Field research of Fortune 500 companies by Malina and Selto (2001) established that management control through BSC appears to positively motivate employees and aligns the organisation to work towards strategy, thus leading to positive results. In a survey of firms in Germany, Austria and Switzerlan, Speckbacher et al. (2003) observed that nearly all the organisations implementing BSC applied all four perspectives of BSC. The study concluded that the commonly expected benefits of using BSC are 'improved company results' and 'improved alignment of strategic objectives with strategy'.

BSC as a Communication Tool

In order to be able to execute strategy, employees must first know and understand it. BSC works as an adept communication tool (Ahn, 2001) which translates the organisational strategy into operational objectives and communicates it suitably to all the employees across the organisation. It emphasises the most appropriate operational thrust areas for each employee. This helps employees get a better understanding of their roles and of the performance related measures for implementing strategy (Greatbanks and Tapp, 2007). During quarterly performance reviews, BSC communicates upwards the performance of each business unit/ department/ team and employee, highlighting clearly where the accountability has failed or bringing out the critical organisational issues that need to beattended in order for the strategy to be implemented successfully (Kaplan and Norton, 1996).

BSC as a Tool for Bringing Alignment

The most significant contribution of Balanced Scorecard is its capability to align the entire organisation. Board of Directors, investors and external partners clubbed with complete alignment within results in economic value add (Kaplan and Norton, 2006). Alignment between different business units creates value. When separate business units and support units are aligned; this synergy creates additional value known as enterprise derived value (Kaplan and Norton, 2006). Creating alignment therefore, is the prime responsibility of the corporate office.

Synergies develop from shared customers, shared processes and services and from leveraging the intangible assets such as leadership, knowledge sharing, organisational and human capital development. The corporate headquarter provide a common theme for the diversified business units, such as 'most valued supplier', 'achieve six-sigma levels for quality' and the operating units interpret these guidelines in their own contexts and build their own balanced scorecard. Similarly, the corporate office also focuses on building common corporate identity and corporate brand that benefits all its business units. The process of cascading of the scorecards aligns the entire organisation towards common goals. It breaks the higher level scorecards into lower levels down to the employee

scorecard whereby measures become meaningful to lower level employees and guide them where to focus their efforts (Davis, 1996). Integrating the IT strategy with the business strategy further provides the competitive edge to the organisation (DerZee and Jong,1999).

BSC as a Change Management Tool

Organisations also use BSC to introduce change, monitor its pace and communicate the status of the change. In order to monitor and control such transformations, it is essential to ensure that measures are aligned with strategic objectives and that the BSC is not cumbersome in terms of number of measures and administrative overhead. Some critical factors normally associated with transformations include clear transformation plan, and strong communication mechanism. It is observed from the studies (MacBryde, et al., 2012) that even in the absence of these transformation plans, BSC provides structure and focus which helps maintain the pace of change. BSC can integrate the performance management system in such a way that it complements the process of strategic transformation.

13 BENCH MARKING

Definitions:

Benching Marking: Traditionally control involves comparison of the actual results with an established standard or target. The practice of setting targets using external information is known as 'Bench marking'.

Benching marking is the establishment - through data gathering of targets and comparatives, with which performance is sought to be assessed.

After examining the firm's present position, benchmarking may provide a basis for establishing better standards of performance. It focuses on improvement in key areas and sets targets which are challenging but evidently achievable. Bench marking implies that there is one best way of doing business and orients the firm accordingly. It is a catching-up exercise and depends on the accurate information about the comparative company – be it inside the group or an outside firm.

Benchmark is the continuous process of enlisting the best practices in the world for the process, goals and objectives leading to world-class levels of achievement.

Types of Benchmarking:

The different types of Benchmarking are:

(i) Product Benchmarking (Reverse Engineering)

(ii) Competitive Benchmarking

(iii) Process Benchmarking

(iv) Internal Benchmarking

(v) Strategic Benchmarking

(vi) Global Benchmarking

(i) Product Benchmarking (Reverse Engineering): is an age old practice of product oriented reverse engineering. Every organization buys its rival's products and tears down to find out how the features and performances etc., compare with its products. This could be the starting point for improvement.

(ii) Competitive Benchmarking: This has moved beyond product-oriented comparisons to include comparisons of process with those of competitors. In this type, the process studied may include marketing, finance, HR, R&D etc.,

(iii) Process Benchmarking: is the activity of measuring discrete performance and functionality against organization through performance in excellent analoguous business process e.g. for supply chain management – the best practice would be that of Mumbai Dubbawallas.

(iv) Internal Benchmarking: is an application of process benchmarking, within an organization by comparing the performance of similar business units or business process.

(v) Strategic Benchmarking: differs from operational benchmarking in its scope. It helps to develop a vision of the changed organizations. It will develop core competencies that will help sustained competitive advantage.

(vi) Global Benchmarking: is an extension of Strategic Benchmarking to include benchmarking partners on a global scale. E.g. Ford Co. of USA benchmarked its A/c payable functions with that of Mazada in Japan and found to its astonishment that the entire function was managed by 5 persons as against 500 in Ford.

Bench Trending and difference with Bench Marking

Bench Trending: Continuous monitoring of specific process performance with a selected group of benchmarking is a systematic and continuous measurement process of comparing through measuring an organization business processes against business leaders (role models) anywhere in the world, to gain information that will help organization take action to improve its performance. The continuous process of enlisting the best practices in the world for the processes, goals and objectives leading to world class levels of achievement.

Benchmarking is the process of comparing the cost, time or quality of what one organization does against what another organization does. The result is often a business case for making changes in order to make improvements.

Benchmarking is a powerful management tool because it overcomes "paradigm blindness". Paradigm Blindness can be summed up as the mode of thinking, "the way we do it is the best because this is the way we've always done it". Bench Marking opens organizations to new methods, ideas and tools to improve their effectiveness. It helps crack through resistance to change by demonstrating other methods of solving problems than the one currently employed and demonstrating that they work, because they are being used by others.

(a) Identify your problem areas.

(b) Identify other industries that have similar processes.

(c) Identify organizations that are leaders in these areas.

(d) Survey companies for measures and practices

(e) Visit the "best practice" companies to identify leading edge practices.

(f) Implement new and improved business practices.

Stages in the process of Bench Marking

The process of benchmarking involves the following stages:

Stage	Description
1	Planning -
	a) Determination of Benchmarking goal statement,
	b) Identification of best performance
	c) Establishment of the benchmarking or process improvement team, and
	d) Defining the relevant benchmarking measures
2	Collection of Data and Information
3	Analysis of the findings based on the data collected in Stage 2
4	Formulation and implementation of recommendations
5	Constant monitoring and reviewing

Various stages in the process of Bench Marking detailed understanding

Stage 1: Planning

(a) Determination of benchmarking goal statement: This requires identification of areas to be benchmarked, which uses the following criteria –

Benchmark for Customer Satisfaction	Benchmark for improving Bottom line (Profit)
• Consistency of product or service	• Waste and reject levels
• Process cycle time	• Inventory levels
• Delivery performance	• Work-in-progress
• Responsiveness to customer requirements	• Cost of Sales
• Adaptability to special needs	• Sales per employee

(c) Identification of best performance: The next step is seeking the "best". To arrive at the best is both expensive and time consuming, so it is better to identify a Company which has recorded performance success in a similar area.

(d) Establishment of the benchmarking or process improvement team: This should include persons who are most knowledgeable about the internal operations and will be directly affected by changes due to benchmarking.

(e) Defining the relevant benchmarking measures: Relevant measures will not be restricted to include the measures used by the Firm today, but they will be refined into measures that comprehend the true performance differences. Developing good measurement is key or critical to successful benchmarking.

Stage 2: Collection of data and information: This involves the following steps –

(a) Compile information and data on performance. They may include mapping processes.

(b) Select and contact partners.

(c) Develop a mutual understanding about the procedures to be followed and, if necessary, prepare a Benchmarking Protocol with partners.

(d) Prepare questions and agree terminology and performance measures to be used.

(e) Distribute a schedule of questions to each partner.

(f) Undertake information and data collection by chosen method for example, interviews, site-visits, telephone tax and e-mail.

(g) Collect the findings to enable analysis.

Stage 3: Analysis of findings:

(a) Review the findings and produce tables, charts and graphs to support the analysis

(b) Identify gaps in performance between out Firm and better performers.

(c) Seek explanations for the gaps in performance. The performance gaps can be positive, negative or zero.

(d) Ensure that comparisons are meaningful and credible

(e) Communicate the findings to those who are affected.

(f) Identify realistic opportunities for improvements. The negative performance gap indicates an undesirable competitive position and provides a basis for performance improvement. If there is no gap it may indicate a neutral position relative to the performance being benchmarked. The zero position should be analysed for identifying means to transform its performance to a level of superiority or positive gap.

Stage 4: Recommendations:

Making recommendations	Implementing recommendations
• Deciding the feasibility of making the improvements in the light of conditions that apply within own Firm	Implement the action plans
• Agreement on the improvements that are likely to be feasible	Monitor performance
• Producing a report on the Benchmarking in which the recommendations are included	Reward and communicate success.

• Obtaining the support of owners/management for making the changes needed.	Keep owners/management informed of progress
• Developing action plan(s) for implementation.	

Stage 5: Monitoring and reviewing: This involves –

(a) Evaluating the benchmarking process undertaken and the results of the improvements against objectives and success criteria plus overall efficiency and effectiveness.

(b) Documenting the lessons learnt and make them available to others.

(c) Periodically re-considering the benchmarks for continuous improvement.

Pre-requisites of Bench Marking Pre-requisites of Bench Marking

1. **Commitment:** Senior Managers should support benchmarking fully and must be omitted to continuous improvements.
2. **Clarity of Objectives:** The objectives should be clearly defined at the preliminary stage. Benchmarking teams have a clear picture of their Firm's performance before approaching others for comparisons.
3. **Appropriate Scope:** The scope of the work should be appropriate in the light of the objectives, resources, time available and the experience level of those involved.
4. **Resources:** Sufficient resources must be available to complete projects within the required time scale.
5. **Skills:** Benchmarking teams should have appropriate skills and competencies.
6. **Communication:** Stakeholders, and also staff and their representatives, are to be kept informed of the reasons for benchmarking.

Define difficulties in implementation of Bench Marking

1. **Time consuming:** Benchmarking is time consuming and at times difficult. It has significant requirement of staff time and Company resources. Companies may waste time in benchmarking non-critical functions.
2. **Lack of management Support:** Benchmarking implementation requires the direct involvement of all managers. The drive to be best in the industry or world cannot be delegated.
3. **Resistance from employees:** It is likely that their maybe resistance from employees.
4. **Paper Goals:** Companies can become pre-occupied with the measures. The goal becomes not to improve process, but to match the best practices at any cost.
5. **Copy-paste attitude:** The key element in benchmarking is the adaptation of a best practice to tailor it to a company's needs and culture. Without that step, a company merely adopts another company's process. This approach condemns benchmarking to fail leading to a failure of bench marking goals.

14 WORKING CAPITAL MANAGEMENT

WORKING CAPITAL MANAGEMENT - FINANCING OF WORKING CAPITAL

WORKING CAPITAL - MEANING & DEFINATION

The term Working Capital also called gross working capital refers to the firm's aggregate of Current Assets and current assets are these assets which can be convertible into cash within an accounting period, generally a year. Therefore, they are Cash or mere cash resources of a business concern. However, we can understand the meaning of Working Capital from the following:

a) "Working capital means the funds available for day-to-day operations of an enterprise. It also represents the excess of current assets over current liabilities including short-term loans". — Accounting Standards Board, The Institute of Chartered Accountants of India.

b) "Working capital is that portion of a firm's current assets which is financed by short term funds."— Gitman, L.J. From the above definitions, we can say that the working capital is the firm's current assets or the excess of current assets over current liabilities. However, the later meaning will be more useful in most of the times as in all cases we may not find excess of current assets over current liabilities.

Concepts of Working Capital

Working capital has two concepts:

ι) Gross working capital and

ιι) Net working capital.

Gross Working capital refers to the total of the current assets and not working capital refers to the excess of the current assets over current liabilities. Though both concepts are important for managing it, gross working capital is more helpful to the management in managing each individual current assets for day-to-day operations. But, in the long run, it is the net working capital that is useful for the purpose.

When we want to know the sources from which funds are obtained, it is not working capital that is more important and should be given greater emphasis. The definition given by the Accountants, U.S.A., will give clear view of working capital which is given below:

Working capital sometimes called net working capital, is represented by excess of current assets over current liabilities and identifies the relatively liquid portion of total enterprise capital which constitutes a margin of better for maturing obligations within the ordinary operation cycle of the business."

Each concern has its own limitations and constraints within which it has to decide whether it should give importance to gross or not working capital.

KINDS OF WORKING CAPITAL

There are two kinds of working capital, the distinction of which made keeping in view the nature of such funds in a business concern, which are as follows:

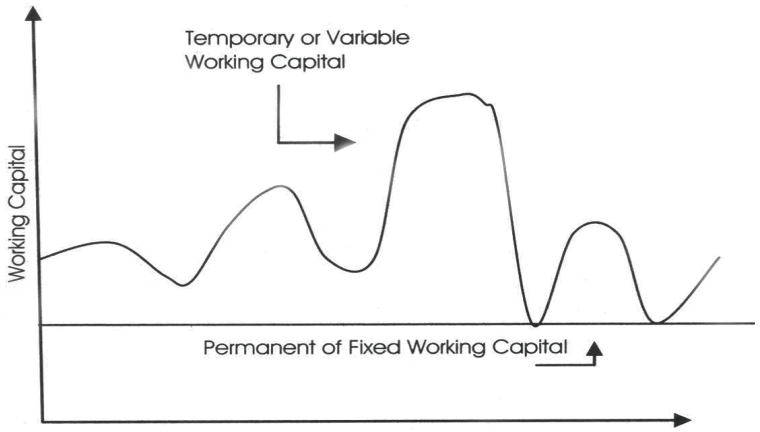
(α) Rigid, fixed, regular or permanent working capital; and

(β) Variable, seasonal, temporary or flexible working capital.

Every business concern has to maintain certain minimum amount of current assets at all times to carry on its activities efficiently and effectively. It is indispensable for any business concern to keep some material as stocks, some in the shape of work-in-progress and some in the form of finished goods. Similarly, it has to maintain certain

amount of cash to meet its day-to-day requirements. Without such minimum amounts, it cannot sustain and carry on its activities. Therefore, some amount of working capital i.e., current assets is permanent in the business without any fluctuations like fixed assets and such amount is called Working Capital. To say precisely, Permanent Working Capital is the irreducible minimum amount of working capital necessary to carry on its activities without any interruptions. It is that minimum amount necessary to outlays its fixed assets effectively.

On the other hand, temporary working capital is that amount of current assets which is not permanent and fluctuating from time to time depending upon the company's requirements and it is generally financed out of short term funds, It may also high due to seasonal character of the industry as such it is also called seasonal working capital.



ADEQUACIES AND INADEQUACIES OF WORKING CAPITAL

Working Capital of a business should be commensurate with its needs. Too high or too low working capital of a business or two extremes of working capital are equally dangerous to the existence of the business enterprise itself.

High amount of working capital, though increases its liquidity position but reduces its profitability and on the other hand too low working capital though increases its profitability reduces its liquidity. Both such extreme situations may cause business concerns to shut down.

DANGER OF TOO HIGH AMOUNT OF WORKING CAPITAL

(α) It results in unnecessary accumulation of inventories and gives chance to inventory mishandling, wastage, pilferage, theft, etc., and losses increase.

(β) Excess working capital means idle funds which earns no profits for the business.

(χ) It shows a defective credit policy of the company resulting in higher incidence of bad debts and adversely affects Profitability.

(δ) It results in overall inefficiency.

DANGER OF INADEQUATE OR LOW AMOUNT OF WORKING CAPITAL

(α) It becomes difficult to implement operating plans and achieve the firm's profit target.

(β) It stagnates growth and it will become difficult to the firm to undertake profitable ventures for non availability of working capital funds.

(χ) It may not be in a position to meet its day-to-day current obligations and results in operational inefficiencies.

(δ) The Return on Investment falls due to under utilisation of fixed assets and other capacities of the business concern.

(ε) Credit facilities in the market will be lost due to faulty working capital.

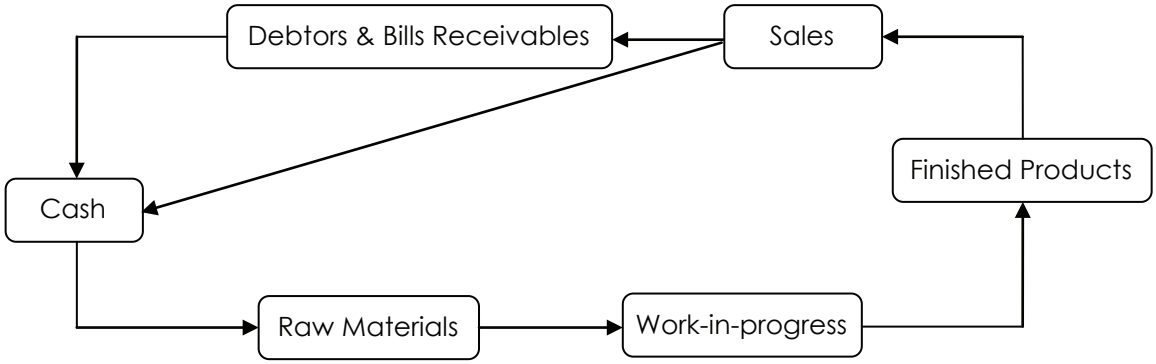
(ϕ) The reputation and goodwill of the firm will also be impaired considerably.

WORKING CAPITAL CYCLE

Working Capital Cycle or Operating Cycle are synonymous terms in the context of management of working capital. Any business concern, whether it is of financial nature, trade organisation or a manufacturing organisation needs certain time to net fruits of the efforts. That is, by investment of cash, producing or doing something for some time will fetch profit. But soon after the investment of cash, it cannot get that profit by way of cash again

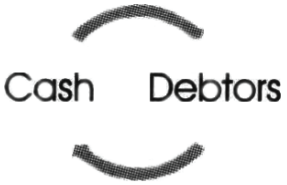
immediately. It takes time to do so. The time required to take from investment of cash in some assets and conversion of it again into cash termed as operating or working capital cycle. Here the cycle refers to the time period.

Chart for Operating Cycle or Working Capital Cycle.



In case of trading concerns, the operating cycle will be: Cash → Stock → Debtors → Cash.

In case of financial concerns, the operating cycle will be: Cash → Debtors → Cash only.



It is obvious from the above that the time gap between the sales and their actual realisation of cash is technically termed as Operating Cycle or Working Capital Cycle.

The period of working capital cycle may differ from one business enterprise to the other depending upon the nature of the enterprise and its activities. It means the pattern of working capital cycle do change according to its activities.

Determinants of Working Capital

The size or magnitude and amount of working capital will not be uniform for all organisations. It differs from one type of organisation to the other type of organisation. Depending upon various conditions and environmental factors of each and every organisation. There are many factors that determine the size of working capital. However, there are some factors, which are common to the most of the business concerns. Such factors are enumerated below:

1. **Nature and size of the Business**: A company's working capital requirements depends on the activities it carried on and its size too. For instance, public utility organisation or service organisation where its activities are of mere service nature, does not require high amount of working capital, as it has no need of maintaining any stocks of inventories. In case of trading organisation the magnitude of working capital is high as it requires to maintain certain stocks of goods as also some credit to debtors. Further, if we go to manufacturing organisation the cycle period of working capital is high because the funds are to be invested in each and every type of inventory forms of raw-material, work-in-progress, finished goods as also debtors. Industrial units

too require a large amount of working capital.

2. **Production Policies:** These policies will have a great significance in determining the size of the working capital. Where production policies are designed in such a way that uniform production is carried on throughout the accounting period, such concern requires a uniform and lesser amount of working capital. On the other hand, the concerns with production policies according to the needs of the customers will be peak at sometimes and require high amount of working capital. In seasonal industries too, where production policies are laid down tightly in the business season requires a high amount of working capital.

3. **Process of Manufacture:** If the manufacturing process of a particular industry is longer due to its complex nature, more working capital is required to finance that process, because, longer the period of manufacture, the larger the inventory tied up in the process and naturally requires a high amount of working capital.

4. **Growth and Expansion of Business:** A business concern at status requires a uniform amount of working capital as against the concerns which are growing and expanding. It is the tendency of any business organisation to grow further and further till its saturation point, if any. Such growth may be within the existing units by increased activities. Similarly, business concerns will expand their organisation by establishing new units. In both the cases, the need for working capital requirement increases as the organisation increases.

5. **Fluctuations in the Trade Cycle**: Business activities vary according to the general fluctuations in the world. There are four stages in a trade cycle which affects the activities of any business concern. Accordingly, the requirements of working capital are bound to change. When conditions of boom prevail, it is the policy of any prudent management to build or pile up large stock of inventories of various forms to take the advantage of the lower prices. Such fluctuations causes a business concern to demand for more amount of working capital. The other phase of trade cycle i.e., depression i.e., low or absence of business activities cause business concerns to demand for more working capital. In condition of depression, the products produced are not sold due to fall in demand, lack of purchasing power of the people. As a result of which entire production obtained was not sold in the market and high inventories are piled up. Therefore, there arises the need for heavy amount of working capital.

   Thus, the two extreme stages of trade cycles make the business concerns to demand for more working capital. In the former case due to acts and policies of management and in the later case due to natural phenomena of trade cycle.

6. **Terms and conditions of Purchases and Sales**: A business concern which allows more credit to its customers and buys its supplies for cash requires more amount of working capital. On the other hand, business concerns which do not allow more credit period to its customers and seek better credit facilities for their supplies naturally require lesser amount of working capital.

7. **Dividend Policy:** A consistent dividend policy may affect the size of working capital. When some amount of working capital is financed out of the internal generation of funds such affect will be there. The relationship between dividend policy and working, capital is well established and very few companies declare dividend without giving due consideration to its effects on cash and their needs for cash.

   If the dividend is to be declared in cash, such outflow reduces working capital and therefore, most of the business concerns declare dividend now-a-days in the form of bonus shares as such retain their cash. A shortage of working capital acts as powerful reason for reducing or skipping cash dividend.

8. **Price Level Changes:** The changes in prices make the functions of a finance manager difficult. The anticipations of future price level changes are necessary to avoid their affects on working capital of the firm. Generally, rising price level will require a company to demand for more amount of working capital, because the same level of current assets requires higher amount of working capital due to increased prices.

9. **Operating Efficiency:** The Operating efficiency of a firm relates to its optimum utilisation of resources available whether in any form of factor of production, say, capital, labour, material, machines etc; If a company is able to effectively operate its costs, its operating cycle is accelerated and requires relatively lessor amount of working capital. On the other hand, if a firm is not able to utilise its resources properly will have slow operating cycle and naturally requires higher amount of working capital.

10. **Percentage of Profits and Appropriation out of Profits:** The capacity of all the firms will not be same in generating their profits. It is natural that some firms enjoy a dominant and monopoly positions due to the quality of its products, reputations, goodwill etc. (for example Colgate Tooth Paste, Bata Chapels etc.,)and some companies will not have such position due to poor quality and other inherent hazards.

    The company policy of retaining or distribution of profits will also affect the working capital. More appropriation out of profits than distribution of profit necessarily reduces the requirements of working capital.

11. **Other Factors:** Apart from the above general considerations, there may be some factors responsible for

determination of working capital which are inherent to the type of business. Some of such factors may be as follows:

(α) General co-ordination and control of the activities in the organisation.

(β) Absence of specialisation of products and their advantages.

(χ) Market facilities.

(δ) Means of transport and communication system.

(ε) Sector in which the firm works i.e., private or public sector etc.

(ϕ) Government policy as regard to: i) Imports and Exports

(γ) Tax considerations.

(η) Availability of labour and its organisation.

(ι) Area in which it is situated such as backward, rural sub-urban, etc.,

Illustration 1:

A company has prepared its annual budget, relevant details of which are reproduced below:

(a) Sales ₹ 46.80 lakhs (25% cash sales and balance on credit)	78,000 units
(b) Raw material cost	60% of sales value
(c) Labour cost	₹ 6 per unit
(d) Variable overheads	₹ 1 per unit
(e) Fixed overheads	₹ 5 lakhs (including ₹ 1,10,000 as depreciation)
(f) Budgeted stock levels:	
Raw materials	3 weeks
Work-in-progress	1 week (Material 100%, Labour & overheads 50%)
Finished goods	2 weeks
(g) Debtors are allowed credit for 4 weeks	
(h) Creditors allow 4 weeks credit	
(i) Wages are paid bi-weekly, i.e. by the 3rd week and by the 5th week for the 1st & 2nd weeks and the 3rd & 4th weeks respectively	
(j) Lag in payment of overheads	2 weeks
(k) Cash-in-hand required	₹ 50,000

Prepare the Working Capital budget for a year for the company, making whatever assumptions that you may find necessary.

Solution:

Unit Selling Price and Cost	(₹)
Selling price (46,80,000 ÷ 78,000)	60
Cost:	
Raw materials (60% of 46,80,000 ÷ 78,000)	36
Labour	6
Variable overheads	1
Fixed overheads (excluding depreciation)	5
Total Cost per unit	48

Statement showing Working Capital Requirement

Current Assets		(₹)
Raw materials	(78,000 units x ₹ 36 x 3/52)	1,62,000
Work-in-progress	(78,000 units x ₹ 42 x 1/52)	63,000
Finished goods	(78,000 units x ₹ 48 x 2/52)	1,44,000
Debtors	(78,000 units x ₹ 60 x 75/100 x 4/52)	2,70,000
Cash in hand		50,000
	(a)	6,89,000
Current Liabilities		
Creditors	(78,000 units x ₹ 36 x 4/52)	2,16,000
Lag in wages	(78,000 units x ₹ 6 x 2/52)	18,000
Lag in payment of overheads	(78,000 units x ₹ 6 x 2/52)	18,000
	(b)	2,52,000
Net working capital required	(a) – (b)	4,37,000

Note:

1. Total sales for 4 weeks is 6,000 units. Excluding 25% cash sales, credit sales amounts to 4,500 units.
2. One year is assumed to be of 52 weeks.

Illustration 2:

A company plans to manufacture and sell 400 units of a domestic appliance per month at a price of ₹ 600 each. The ratio of costs to selling price are as follows:

	(% of selling price)
Raw materials	30%
Packing materials	10%
Direct labour	15%
Direct expense	5%

Fixed overheads are estimated at ₹ 4,32,000 per annum.

The following norms are maintained for inventory management:

Raw materials	30 days
Packing materials	15 days
Finished goods	200 units
Work-in-progress	7 days

Other particulars are given below:

(α) Credit sales represent 80% of total sales and the dealers enjoy 30 working days credit. Balance 20% are cash sales.

(β) Creditors allow 21 working days credit for payment.

(χ) Lag in payment of overheads and expenses is 15 working days.

(δ) Cash requirements to be 12% of net working capital.

(ε) Working days in a year are taken as 300 for budgeting purpose.

Prepare a Working Capital requirement forecast for the budget year.

Solution:

Selling Price and Cost per unit ₹

Raw materials (₹ 600 x 30/100)	180
Packing materials (₹ 600 x 10/100)	60
Direct labour (₹ 600 x 15/100)	90
Direct expenses (₹ 600 x 5/100)	30
Fixed overheads [₹ 4,32,000 / (400 x 12)]	90
Total cost	450
Profit	150
Selling Price per unit	600

Forecast of Working Capital Requirement: ₹

Current Assets		
Raw materials stock	(₹ 4800 x 180 x 30/300)	86,400
Packing materials stock	(₹ 4800 x 60 x 15/300)	14,400
Working in progress	(₹ 4800 x 285 x 7/300)	31,920
Finished goods stock	(₹ 450 x 200 units)	90,000
Debtors	(₹ 4800 x 80/100 x ₹ 600 x 30/300)	2,30,400
(a)		4,53,120
Current Liabilities:		
Creditors for raw material suppliers	(₹ 4800 x 180 x 21/300)	60,480
Creditors for packing material	(₹ 4800 x 60 x 21/300)	20,160
Creditors for expenses and overheads	(₹ 4800 x 120 x 15/300)	28,800
(b)		1,09,440
Net Working Capital	(a) – (b)	3,43,680
Add: Cash required (12% of net working capital)		41,242
Total Working Capital Required		3,84,922

Note:

- Work in progress is valued with raw material cost at 100% and 50% of wages, overheads and expenses.
- Debtors are valued at selling price.

Illustration 3:

A Company provided the following data:

	Cost per unit (₹)
Raw materials	52.00
Direct labour	19.50
Overheads	39.00
Total Cost	110.50
Profit	19.50
Selling Price	130.00

The following additional information is available:

(α) Average raw materials in stock: one month.

(β) Average materials in process: half-a-month

(χ) Average finished goods in stock: one month

(δ) Credit allowed by suppliers: one month

(ε) Credit allowed to debtors: two months.

(ϕ) Time lag in payment of wages: one and a half weeks.

(γ) Overheads: one month

(η) One-fourth of sales are on cash basis.

(ι) Cash balance is expected to be ₹ 1,20,000.

You are required to prepare a statement showing the Working Capital needed to finance a level of activity of 70,000 units of annual output. The production is carried throughout the year on even basis and wages and overheads accrue similarly. (Calculation be made on the basis of 30 days a month and 52 weeks a year).

Solution:

Statement showing estimate of Working Capital

Current Assets	(₹)	(₹)
Stock of Raw material (70,000 units x 52 x 30/360)		3,03,333
Work-in-progress:		
Raw materials (70,000 units x 52 x 15/360)	1,51,667	
Direct labour (70,000 units x 19.50 x 30/360 x 1/4)	28,437	
Overheads (70,000 units x 39 x 30/360 x 1/4)	56,875	2,36,979
Stock of finished goods (70,000 units x 110.50 x 30/360)		6,44,583
Debtors (70,000 units x 130 x 60/360)		15,16,667
Cash balance		1,20,000
	(a)	28,21,562
Current Liabilities:		
Creditors for raw material (70,000 units x 52 x 30/360)		3,03,333
Creditors for wages (70,000 units x 19.50 x 1.5/52)		39,375
Creditors for overheads (70,000 units x 39 x 30/360)		2,27,500
	(b)	5,70,208
Net Working Capital	(a) – (b)	22,51,354

Illustration 4:

From the following data, compute the duration of the operating cycle for each of years:

	Year1 (₹)	Year 2 (₹)
Stock:		
Raw materials	20,000	27,000
Work-in-progress	14,000	18,000
Finished goods	21,000	24,000
Purchases	96,000	1,35,000
Cost of goods sold	1,40,000	1,80,000
Sales	1,60,000	2,00,000
Debtors	32,000	50,000
Creditors	16,000	18,000

Assume 360 days per year for computational purposes.

Solution:

Calculation of operating cycle

	Year 1	Year 2
Current Assets: 1. Raw material stock = $\frac{\text{Stock of raw material}}{\text{Purchases}} \times 360$	(20 / 96) x 360 = 75 days	(27 / 135) x 360 = 72 days
2. WIP turnover = (WIP / COGS) x 360	(14 / 140) x 360 = 36 days	(18 / 180) x 360 = 36 days
3. Finished goods turnover = (Finished good/ COGS)× 360	(21 / 140) x 360 = 54 days	(24 / 180)x 360 = 48 days
4. Debtors turnover = (Debtors / Sales) x 360	(32 / 160) x 360 = 72 days	(50 / 200)x 360 = 90 days
Total (A)	237 days	246 days
Creditors period = (Creditors / Purchases)x 360	(16 / 96) x 360 = 60 days	(18 / 135) x 360 = 48 days
Total (B)	60 days	48 days
Operating cycle (A-B)	177 days	198 days

Illustration 5:

(a) From the following details, prepare an estimate of the requirement of Working Capital:

Production	60,000 units
Selling price per unit	₹ 5
Raw material	60% of selling price
Direct wages	10% of selling price
Overheads	20% of selling price
Materials in hand	2 months requirement
Production Time	1 month
Finished goods in Stores	3 months
Credit for Material	2 months
Credit allowed to Customers	3 months
Average Cash Balance	₹ 20,000

Wages and overheads are paid at the beginning of the month following/In production all the required materials are charged in the initial stage and wages and overheads accrue evenly.

(b) What is the effect of Double Shift Working on the requirement of Working capital?

Solution:

a) Computation of requirement of Working Capital

Annual production 60,000 units

Monthly production 5,000 units

Unit Cost Sheet

Particulars		(₹)
Selling price		5.00
Cost of Raw Material	60% of 5=3.00	
Wages	10% of 5=0.50	
Overheads	20% of 5=1.00	
Total cost per unit		4.50
Profit per unit		0.50

Current Assets:		(₹)	(₹)
Stock of Raw material	3 x 60000 x $\frac{2}{12}$		30,000
Work in Progress:			
Raw Materials	1 3 x 60,000 x $\frac{1}{12}$	15,000	
Wages + Overheads	1.50 x 60,000 x $\frac{1}{12}$ x $\frac{1}{2}$	3,750	18,750
Stock of Finished Goods	4.50 x 60,000 x $\frac{3}{12}$		67,500
Debtors (on sales)	5.00 x 60,000 x $\frac{3}{12}$		75,000
Cash			20,000
Total Current Assets	(A)		2,11,250

Current Liabilities:		
Creditors	3 x 60,000 x $\frac{2}{12}$	30,000
Outstanding wages	0.5 x 60,000 x $\frac{1}{12}$	2,500
Outstanding overheads	1 x 60,000 x $\frac{1}{12}$	5,000
Total Current Liabilities (B)		37,500

Working Capital: (A-B) = 2,11,250 – 37,500 = ₹ 1,73,750

b) Effects of Double shift working:

The following assumptions are made before estimating the Working Capital requirement for double shift working:

1. Production will be 10000 units per month or 1,20,000 units per year.
2. Materials may not be required at double rate. Due to inventory control measures it may be taken as 2/3
3. WIP will be the same at 5000 units. This will not increase as WIP of first shift will be handed over to second shift.
4. 50% of overheads are assumed as fixed. This will not increase due to double shift working.

On the basis of above assumptions, the following capital requirement is estimated as follows:

Current Assets:			(₹)
Stock of Raw material		30,000 + 30000 x $\frac{2}{3}$	50,000
Work in Progress:			

Raw materials	$3 \times 60,000 \times \frac{2}{3}$	15,000	
Wages + Overheads	$**1.25 \times 60,000 \times \frac{1}{12} \times \frac{1}{2}$	3,125	18,125
Stock of finished Goods	$4.25 \times 1,20,000 \times \frac{3}{12}$		1,27,500
Debtors (on sales)	$5.00 \times 1,20,000 \times \frac{3}{12}$		1,50,000
Cash (double)			40,000
Total Current Assets	(A)		3,85,625

Current liabilities:		(₹)
Creditors	$3 \times 1,20,000 \times \frac{1}{2}$	60,000
Outstanding wages	$0.5 \times 1,20,000 \times \frac{1}{2}$	5,000
Outstanding overheads (Fixed Overheads remain same)	2,500	
(Variable Overheads double as before)	5,000	7,500
Total Current Liabilities (B)		72,500

Working Capital required for two shifts: (A-B) = 3,85,625 – 72,500 = ₹ 3,13,125

Therefore additional working capital required for second shift = 3,13,125 – 1,73,750 = ₹ 1,39,375

** Calculation of Cost per unit

₹

	Single shift	Double shift
Raw material Cost	3.00	3.00
Wages	0.50	0.50
Overhead expenses:		
Fixed	0.50	0.25
Variable	0.50	0.50
Cost per unit	4.50	4.25

→ Production in 2 shifts are doubled

INVENTORY MANAGEMENT

Inventory constitutes an important item in the working capital of many business concerns. Net working capital is the difference between current assets and current liabilities. Inventory is a major item of current assets. The term inventory refers to the stocks of the product a firm is offering for sale and the components that make up the product. Inventory is stores of goods and stocks. This includes raw materials, work-in-process and finished goods. Raw materials consist of those units or input which are used to manufacture goods that require further processing to become finished goods. Finished goods are products ready for sale. The classification of inventory and the levels of the components vary from organisation to organisation depending upon the nature of business. For

example steel is a finished product for a steel industry, but raw material for an automobile manufacturer. Thus, inventory may be defined as "Stock of goods that is held for future use". Since inventory constitute about 50 to 60 percent of current assets, the management of inventories is crucial to successful Working Capital Management. Working capital requirements are influenced by inventory holding. Hence, there is a need for effective and efficient management of inventory

A good inventory management is important to the successful operations of the most of the organizations, unfortunately the importance of inventory is not always appreciated by top management. This may be due to a failure to recognize the link between inventory and achievement of organisational goals or due to ignorance of the impact that inventory can have on costs and profits.

Inventory management refers to an optimum investment in inventory. It should neither be too low to effect the production adversely nor too high to block the funds unnecessarily. Excess investment in inventory is unprofitable for the business. Both excess and inadequate investment in inventory is not desirable. The firm should operate within the two danger points. The purpose of inventory management is to determine and maintain the optimum level of inventory investment.

Techniques and Tools of Inventory Control:

1. Economic Order Quantity.
2. Fixing Levels of Material.
   - (α) Minimum Level
   - (β) Maximum Level
   - (χ) Reorder Level
   - (δ) Danger Level
3. ABC Inventory Control
4. Perpetual Inventory System
5. VED classification.
6. Just-In-Time
7. FSN Analysis
8. Inventory Turnover Ratio

MANAGEMENT OF RECEIVABLES

Receivables mean the book debts or debtors and these arise, if the goods are sold on credit. Debtors form about 30% of current assets in India. Debt involves an element of risk and bad debts also. Hence, it calls for careful analysis and proper management. The goal of Receivables Management is to maximize the value of the firm by achieving a trade off between risk and profitability.

The objectives of Receivables Management are as follows:

(α) To obtain optimum (non-maximum) value of sales;

(β) To control the cost of receivables, cost of collection, administrative expenses, bad debts and opportunity cost of funds blocked in the receivables.

(χ) To maintain the debtors at minimum according to the credit policy offered to customers.

(δ) To offer cash discounts suitably depending on the cost of receivables, bank rate of interest and opportunity cost of funds blocked in the receivables.

Costs of Maintaining Receivables

The costs with respect to maintenance of receivables can be identified as follows:

Capital costs: Maintenance of accounts receivable results in blocking of the firm's financial resources in them. This is because there is a time lag between the sale of goods to customers an the payments by them. The firm has, therefore, to arrange for additional funds to meet its own obligations, such as payment to employees, suppliers of raw materials, etc.

Administrative costs: The firm has to incur additional administrative costs for maintaining accounts receivable in the form of salaries to the staff kept for maintaining accounting records relating to customers, cost of conduct-

ing investigation regarding potential credit customers to determine their credit worthiness etc.

Collection costs: The firm has to incur costs for collecting the payments from its credit customers. Sometimes, additional steps may have to be taken to recover money from defaulting customers.

Defaulting costs: Sometimes after making all serious efforts to collect money from defaulting customers, the firm may not be able to recover the overdues because of the inability of the customers. Such debts are treated as bad debts and have to be written off since they cannot be realised.

Benefits of Maintaining Receivables

Increase in Sales: Except a few monopolistic firms, most of the firms are required to sell goods on credit, either because of trade customers or other conditions. The sales can further be increased by liberalizing the credit terms. This will attract more customers to the firm resulting in higher sales and growth of the firm.

Increase in Profits: Increase in sales will help the firm (i) to easily recover the fixed expenses and attaining the break-even level, and (ii) increase the operating profit of the firm. In a normal situation, there is a positive relation between the sales volume and the profit.

Extra Profit: Sometimes, the firms make the credit sales at a price which is higher than the usual cash selling price. This brings an opportunity to the firm to make extra profit over and above the normal profit.

Factors Affecting the size of receivables

The size of accounts receivable is determined by a number of factors. Some of the important factors are as follows:

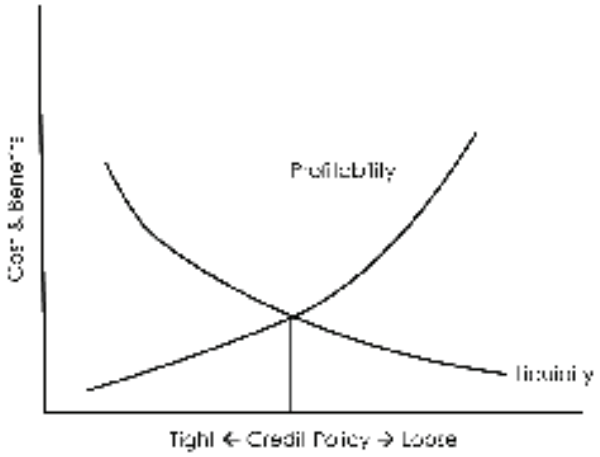
Level of sales: This is the most important factor in determining the size of accounts receivable. Generally in the same industry, a firm having a large volume of sales will be having a larger level of receivables as compared to a firm with a small volume of sales.

Credit policies: A firm's credit policy, as a matter of fact, determines the amount of risk the firm is willing to undertake in its sales activities. If a firm has a lenient or a relatively liberal credit policy, it will experience a higher level of receivables as compared to a firm with a more rigid or stringent credit policy.

Terms of trade: The size of the receivables is also affected by terms of trade (or credit terms) offered by the firm. The two important components of the credit terms are (i) Credit period and (ii) Cash discount.

Optimum Size of Receivables

The optimum investment in receivables will be at a level where there is a trade-off between costs and profitability. When the firm resorts to a liberal credit policy, the profitability of the firm increases on account of higher sales. However, such a policy results in increased investment in receivables, increased chances of bad debts and more collection costs. The total investment in receivables increases and, thus, the problem of liquidity is created. On the other hand, a stringent credit policy reduces the profitability but increases the liquidity of the firm. Thus, optimum credit policy occurs at a point where there is a "Tradeoff" between liquidity and profitability as shown in the chart below.



The following are the aspects of credit policy:

(i) Level of credit sales required to optimise the profit.

(ii) Credit period i.e. duration of credit, whether it may be 15 days or 30 or 45 days etc.

(iii) Cash discount, discount period and seasonal offers.

(iv) Credit standard of a customer : 5 C's of credit :

- (α) Character of the customer i.e. willingness to pay.
- (β) Capacity----ability to pay.
- (χ) Capital----financial resources of a customer.
- (δ) Conditions----special conditions for extension of credit to doubtful customers and prevailing economic and market conditions and;
- (ε) Collateral security.

(v) Profits.

(vi) Market and economic conditions.

(vii) Collection policy.

(viii) Paying habits of customers.

(ix) Billing efficiency, record-keeping etc.

(x) Grant of credit----size and age of receivables.

DETERMINANT OF CREDIT POLICY

A firm should establish receivables policies after carefully considering both benefits and costs of different policies. These policies relate to:

(i) Credit Standards, (ii) Credit Terms, and (iii) Collection Procedures.

Each of these have been explained below:

(i) Credit Standards

The term credit standards represent the basic criteria for extension of credit to customers. The levels of sales and receivables are likely to be high if the credit standards are relatively loose, as compared to a situation when they are relatively tight. The firm's credit standards are generally determined by the five "C's". Character, Capacity, Capital, Collateral and Conditions. Character denotes the integrity of the customer, i.e. his willingness to pay for the goods purchased. Capacity denotes his ability to manage the business. Capital denotes his financial soundness. Collateral refers to the assets which the customer can offer by way of security. Conditions refer to the impact of general economic trends on the firm or to special developments in certain areas of economy that may affect the customer's ability to meet his obligations.

Information about the five C's can be collected both from internal as well as external sources. Internal sources include the firm's previous experience with the customer supplemented by its own well developed information system. External resources include customer's references, trade associations and credit rating organizations.

(ii) Credit terms

It refers to the terms under which a firm sells goods on credit to its customers. As stated earlier, the two components of the credit terms are (a) Credit Period and (b) Cash Discount. The approach to be adopted by the firm in respect of each of these components is discussed below:

(iii) Collection procedures

A stringent collection procedure is expensive for the firm because of high out-of-pocket costs and loss of goodwill of the firm among its customers. However, it minimises the loss on account of bad debts as well as increases savings in terms of lower capital costs on account of reduction in the size of receivables. A balance has therefore to be stuck between the costs and benefits of different collection procedures or policies.

Credit evaluation of customer

Credit evaluation of the customer involves the following 5 stages:

(i) Gathering credit information of the customer through:

- (α) financial statements of a firm,

(β) bank references,

(χ) references from Trade and Chamber of Commerce,

(δ) reports of credit rating agencies,

(ε) credit bureau reports,

(ϕ) firm's own records (Past experience),

(γ) other sources such as trade journals, Income-tax returns, wealth tax returns, sales tax returns, Court cases, Gazette notifications etc.

(ii) Credit analysis – After gathering the above information about the customer, the credit-worthiness of the applicant is to be analysed by a detailed study of 5 C's of credit as mentioned above.

(iii) Credit decision – After the credit analysis, the next step is the decision to extend the credit facility to potential customer. If the analysis of the applicant is not upto the standard, he may be offered cash on delivery (COD) terms even by extending trade discount, if necessary, instead of rejecting the credit to the customer.

(iv) Credit limit – If the decision is to extend the credit facility to the potential customer, a limit may be prescribed by the financial manager, say, ₹ 25,000 or ₹ 1,00,000 or so, depending upon the credit analysis and credit-worthiness of the customer.

(v) Collection procedure – A suitable and clear-cut collection procedure is to be established by a firm and the same is to be intimated to every customer while granting credit facility. Cash discounts may also be offered for the early payment of dues. This facilities faster recovery.

Illustration 1

Gemini Products Ltd. is considering the revision of its credit policy with a view to increasing its sales and profits. Currently all its sales are on credit and the customers are given one month's time to settle the dues. It has a contribution of 40% on sales and it can raise additional funds at a cost of 20% per annum. The marketing director of the company has given the following options with draft estimates for consideration.

Particulars	Current position	Option I	Option II	Option III
Sales (₹ Lakhs)	200	210	220	250
Credit period (months)	1	1½	2	3
Bad debts (% of sales)	2	2½	3	5
Cost of credit administration (₹ Lakhs)	1.20	1.30	1.50	3.00

Advise the company to take the right decision. (Workings should form part of the answer).

Solution:

Evaluation of the different options in credit policy of Gemini Products Ltd. (₹ in Lakhs)

Credit period (months)	Current 1.0	Option I (1.5)	Option II (2.0)	Option III (3.0)
Sales	200	210	220	250
Less: Variable cost (60%)	120	126	132	150
Contribution (a)	80.00	84.00	88.00	100.00
Less: Costs				
Cost of funds invested in debtors balance	3.33	5.25	7.33	12.50
Bad debts	4.00	5.25	6.60	12.50
Cost of credit administration	1.20	1.30	1.50	3.00
(b)	8.53	11.80	15.43	28.00
Net contribution (a) – (b)	71.47	72.20	72.57	72.00

Analysis:

Since the net contribution is highest in option II, it is suggested to extend 2 months credit period to the customers.

Illustration 2

Surya Industries Ltd. is marketing all its products through a network of dealers. All sales are on credit and the dealers are given one month time to settle bills. The company is thinking of changing the credit period with a view to increase its overall profits. The marketing department has prepared the following estimates for different periods of credit:

Particulars	Present Policy	Plan I	Plan II	Plan III
Credit period (in months)	1	1.5	2	3
Sales (₹ Lakhs)	120	130	150	180
Fixed costs (₹ Lakhs)	30	30	35	40
Bad debts (% of sales)	0.5	0.8	1	2

The company has a contribution/sales ratio of 40% further it requires a pre-tax return on investment at 20%. Evaluate each of the above proposals and recommend the best credit period for the company.

Solution:

Analysis of Credit Policies (₹ in Lakhs)

Credit Period (months)	Current Policy (1)	Plan I (1.5)	Plan II (2)	Plan III (3)
Credit sales	120	130	150	180
Less: Variable cost @ 60%	72	78	90	108
Contribution	48	52	60	72
Less: Fixed cost	30	30	35	40
Operating Profit (a)	18	22	25	32
Cost of Sales (Variable Cost + Fixed Cost)	102	108	125	148
Investment in debtors [Cost of sales x Credit period / 12 months)	8.5	13.5	20.83	37.00
Cost of Investment in debtors @ 20% (b)	1.70	2.70	4.17	7.40
Credit sales	120	130	150	180
Bad debts (% of sales)	0.5%	0.8%	1%	2%
Bad debts (c)	0.60	1.04	1.50	3.60
Net Profit (a) – [(b) + (c)]	15.70	18.26	19.33	21.00

Analysis:

The net profit is higher if 3 months credit period is allowed. Hence, it is suggested to adopt plan III.

Illustration 3

The following are the details regarding the operations of a firm during a period of 12 months.

Sales	₹ 12,00,000
Selling price per unit	₹ 10
Variable cost price per unit	₹ 7
Total cost per unit	₹ 9

Credit period allowed to customers one month. The firm is considering a proposal for a more liberal extension of credit which will result in increasing the average collection period from one month to two months. This relaxation is expected to increase the sales by 25% from its existing level.

You are required to advise the firm regarding adoption of the new credit policy, presuming that the firm's required return on investment is 25%.

Solution:

Appraisal of Credit policy

(₹)

Particulars	Present	Proposed	Incremental
Credit period(ACP)	1 month	2 months	1 months
Sales (units)	1,20,000	1,50,000	30,000
Sales @ 10(in ₹)	12,00,000	15,00,000	3,00,000
Total Cost	10,80,000	12,90,000	2,10,000
Profit	1,20,000	2,10,000	90,000
Investment in receivables	10,80,000 / 12 = 90,000	12,90,000 / 6 = 2,15,000	1,25,000

Required return on Incremental Investment (1,25,000@ 25%) = 31,250

Actual return on Investment = 90,000

(or)

(90,000 / 1,25,000) x 100 = 72%

Since the Incremental return is greater than required return on Incremental investment advised to adopt new credit policy.

Illustration 4

Trinadh Traders Ltd. currently sells on terms of next 30 days. All the sales are on credit basis and average collection period is 35 days. Currently, it sells 5,00,000 units at an average price of ₹ 50 per unit. The variable cost to sales ratio is 75% and a bad debt to sales ratio is 3%. In order to expand sales, the management of the company is considering changing the credit terms from net 30 to '2/10, net 30'. Due to the change in policy, sales are expected to go up by 10%, bad debt loss on additional sales will be 5% and bad debt loss on existing sales will remain unchanged at 3%. 40% of the customers are expected to avail the discount and pay on the tenth day. The average collection period for the new policy is expected to be 34 days. The company required a return of 20% on its investment in receivables.

You are required to find out the impact of the change in credit policy of the profit of the company. Ignore taxes.

Solution:

Trinadh Traders
Appraisal of Credit Policy (₹)

	Present	Proposed	Gain/Loss)
Credit terms	Net 30	(2 / 10)Net 30	
Avg. Collection Period	35 days	34 days	
Discount sales	-	40%	
Bad debts	3%	3 % + 5%	
Sales (units)	5,00,000	5,50,000	
Incremental Contribution [50,000 x 50 x 25%]			6,25,000
Incremental bad debts [50,000 x 50 x 5%]			(1,25,000)
Discount [5,50,000 x 40% x 50 x 2%]			(2,20,000)
Investment in Receivables	[5,00,000 x 50 x (35/360)] = 24,30,555	[5,00,000 x 50 x (37/365)] + [50,000 x 50 x 75% x 34/360] = 25,38,194	
Incremental investment		1,07,629	
Finance cost (1,07,629 x 20%)			(21,528)
Incremental gain			2,58,472

By implementing new credit policy, the profit is increased by ₹2,58,472. So the new credit policy is advised to implement.

Illustration 5

A firm is considering pushing up its sales by extending credit facilities to the following categories of customers:

(α) Customers with a 10% risk of non-payment, and

(β) Customers with a 30% risk of non-payment.

The incremental sales expected in case of category (a) are ₹40,000 while in case of category (b) they are ₹50,000.

The cost of production and selling costs are 60% of sales while the collection costs amount to 5% of sales in case of category (a) and 10% of sales in case of category (b).

You are required to advise the firm about extending credit facilities to each of the above categories of customers.

Solution:

Evaluation of Credit Policies

Category a) 10% risk of non-payment

Particulars		(₹)
Incremental sales		40,000
Less: Bad debts @ 10%		4,000
Sales realized		36,000
Less: Cost of production and selling cost (40,000 x 60%)	24,000	
Less: Collection cost (40,000 x 5%)	2,000	26,000
Incremental profit		10,000

Category b) 30% risk of non-payment

		(₹)
Incremental sales		50,000
Less: Bad debts @ 30% (50,000 x 30%)		15,000
Sales realized		35,000
Less: Cost of production and selling cost (50,000 x 60%)	30,000	
Less: Collection cost (50,000 x 10%)	5,000	35,000
Incremental profit		Nil

Comment: Advise to extend credit facility to category (a) customers alone.

Illustration 6

The PKJ Company currently sells on terms 'net 45'. The company has sales of ₹37.50 Lakhs a year, with 80% being the credit sales. At present, the average collection period is 60 days. The company is now considering offering terms '2/10, net 45'. It is expected that the new credit terms will increase current credit sales by 1/3rd. The company also expects that 60% of the credit sales will be on discount and average collection period will be reduced to 30 days. The average selling price of the company is ₹100 per unit and variable cost is 85% of selling price. The Company is subject to a tax rate of 40%, and its before-tax rate of borrowing for working capital is 18%. Should the company change its credit terms to '2/10, net 45'? Support your answers by calculating the expected change in net profit. (Assume 360 days in a year)

Solution:

Appraisal of new credit policy

	Present	Proposed	Incremental
Credit term	"net 45"	"2/10 net 45"	
Average collection period	60 days	30 days	
Discount sales	-	60%	
	(₹)	(₹)	(₹)
1. Credit sales (37,50,000 x 80%)	30,00,000	40,00,000	
2. Variable Cost 85%	25,50,000	34,00,000	
3. Contribution (1-2)	4,50,000	6,00,000	1,50,000
4. Discount (40,00,000 x 60% x 2%)		48,000	(48,000)
5. Investment in debtors			
$30,00,000 \times \frac{60}{360}$	5,00,000		
$30,00,000 \times \frac{30}{360} + 10,00,000 \times 85\% \times \frac{30}{360}$		3,20,833	
6. Savings in investment	-	1,79,167	
7. Finance cost saved (1,79,167 x 10.8%)*			19,350
8. Surplus (3-4+7)			1,21,350

Decision: Advised to implement the proposed policy, as there is a surplus of ₹ 1,21,350 * Cost of capital = Rate of interest x (1-tax rate) = 18% x (1-0.4) = 10.8%

Illustration 7

Slow Players are regular customers of Goods Dealers Ltd., Calcutta and have approached the sellers for extension of credit facility for enabling them to purchase goods from Goods Dealers Ltd. On the analysis of past performance and on the basis of information supplied, the following pattern of payment schedule emerges in regard to Slow Players:

Schedule	Pattern
At the end of 30 days	15% of the bill
60 days	34% of the bill
90 days	30% of the bill
100 days	20% of the bill
Non recovery	1% of the bill

Slow Players wants to enter into a firm commitment for purchase of goods of ₹ 15,00,000 in 2012, deliveries to be made in equal quantities on the first day of each quarter in the calendar year. The price per unit of the commodity is ₹ 150 on which a profit of ₹ 5 per unit is expected to be made. It is anticipated by the Good Dealers Ltd., that taking up of this contract would mean an extra recurring expenditure of ₹ 5,000 per annum. If the opportunity cost of funds in the hands of Goods Dealers is 24% per annum, would you as the Finance Manager of the seller recommend the grant of credit to Slow Players? Working should form part of your answer.

Solution:

Appraisal of credit proposal from Slow Players:

(α) Incremental profit = $15,00,000 \times \frac{5}{150}$ = ₹ 50,000

(β) Calculation of incremental finance cost: 17,975* x 4 = ₹ 71,900

*Sales per quarter = $\frac{15,00,000}{4}$ = ₹ 3,75,000

Finance cost per quarter:

		₹
For 15% of bill	3,75,000 x 15% x 24% x $\frac{30}{360}$	1,125
For 34% of bill	3,75,000 x 34% x 24% x $\frac{60}{360}$	5,100
For 30% of bill	3,75,000 x 30% x 24% x $\frac{90}{360}$	6,750
For 20% of bill	3,75,000 x 20% x 24% x $\frac{100}{360}$	5,000
Finance cost per quarter		17,975

(χ) Extra recurring expenses = ₹ 5,000

(δ) Bad debts = 15,00,000 x 1% = ₹ 15,000

Therefore, incremental profit = a-b-c-d = 50,000 – 71,900 – 5,000 – 15,000 = ₹ 41,900 (loss)

Comment: As there is incremental loss, it is advice not to extend credit facility to slow players.

15 CASH AND LIQUIDITY MANAGEMENT

CASH MANAGEMENT

The term "Cash" with reference to management of cash is used in two ways. In a narrow sense cash refers to coins, currency, cheques, drafts and deposits in banks. The broader view of cash includes near cash assets such as marketable securities and time deposits in banks. The reason why these near cash assets are included in cash is that they can readily be converted into cash. Usually, excess cash is invested in marketable securities as it contributes to profitability. Cash is one of the most important components of current assets. Every firm should have adequate cash, neither more nor less. Inadequate cash will lead to production interruptions, while excessive cash remains idle and will impair profitability. Hence, there is a need for cash management. The cash management assumes significance for the following reasons:-

Significance

(i) **Cash planning:** Cash is the most important as well as the least unproductive of all current assets. Though, it is necessary to meet the firm's obligations, yet idle cash earns nothing. Therefore, it is essential to have a sound cash planning neither excess nor inadequate.

(ii) **Management of cash flows:** This is another important aspect of cash management. Synchronisation between cash inflows and cash outflows rarely happens. Sometimes, the cash inflows will be more than outflows because of receipts from debtors, and cash sales in huge amounts. At other times, cash outflows exceed inflows due to payment of taxes, interest and dividends etc. Hence, the cash flows should be managed for better cash management.

(iii) **Maintaining optimum cash balance:** Every firm should maintain optimum cash balance. The management should also consider the factors determining and influencing the cash balances at various point of time. The cost of excess cash and danger of inadequate cash should be matched to determine the optimum level of cash balances.

(iv) **Investment of excess cash:** The firm has to invest the excess or idle funds in short term securities or investments to earn profits as idle funds earn nothing. This is one of the important aspects of management of cash.

Thus, the aim of cash management is to maintain adequate cash balances at one hand and to use excess cash in some profitable way on the other hand.

Motives

Motives or desires for holding cash refers to various purposes. The purpose may be different from person to person and situation to situation. There are four important motives to hold cash.

(i) To carry out the regular business transactions.

(ii) As a precautionary measure to meet the business exigencies.

(iii) In order to exploit the profitable opportunities under speculative conditions.

(iv) To compensate banks and other financial institutes for providing certain services and loans.

Objectives

The basic objectives of cash management are

(i) to make the payments when they become due and

(ii) to minimize the cash balances.

The task before the cash management is to reconcile the two conflicting nature of objectives.

Factors determining cash needs

Maintenance of optimum level of cash is the main problem of cash management. The level of cash holding differs from industry to industry, organisation to organisation. The factors determining the cash needs of the industry is explained as follows:

(i) **Matching of cash flows**: The first and very important factor determining the level of cash requirement is matching cash inflows with cash outflows. If the receipts and payments are perfectly coincide or balance each other, there would be no need for cash balances. The need for cash management therefore, due to the non-synchronisation of cash receipts and disbursements.

(ii) **Short costs**: Short costs are defined as the expenses incurred as a result of shortfall of cash. The short costs includes, transaction costs associated with raising cash to overcome the shortage, borrowing costs associated with borrowing to cover the shortage i.e. interest on loan, loss of trade-discount, penalty rates by banks to meet a shortfall in cash balances and costs associated with deterioration of the firm's credit rating etc. which is reflected in higher bank charges on loans, decline in sales and profits.

(iii) **Cost of excess cash balances**: One of the important factors determining the cash needs is the cost of maintaining cash balances i.e. excess or idle cash balances. The cost of maintaining excess cash balance is called excess cash balance cost.

(iv) **Uncertainty in business:** The first requirement of cash management is a precautionary cushion to cope with irregularities in cash flows, unexpected delays in collections and disbursements and defaults. The uncertainty can be overcome through accurate forecasting of tax payments, dividends, capital expenditure etc. and ability of the firm to borrow funds through over draft facility.

(v) **Cost of procurement and management of cash**: The costs associated with establishing and operating cash management staff and activities determining the cash needs of a business firm. These costs are generally fixed and are accounted for by salary, storage and handling of securities etc. The above factors are considered to determine the cash needs of a business firm.

The strategies for cash management are discussed in detail in the following lines:

I) Projection of cash flows and planning: The cash planning and the projection of cash flows is determined with the help of Cash Budget. The Cash Budget is the most important tool in cash management. It is a device to help a firm to plan and control the use of cash. It is a statement showing the estimated cash inflows and cash outflows over the firm's planning horizon. In other words the net cash position i.e., surplus or deficiency of a firm is highlighted by the cash budget from one budgeting period to another period.

II) Determining optimal level of cash holding by the company

The optimal level of cash holding by a company can be determined with the help of the following models:

(α) Inventory model (Economic Order Quantity) to cash management

(β) Stochastic model

(χ) Probability model

[(a) Inventory model (EOQ) to cash management (Baumol model)]: Economic Order Quantity (EOQ) model is used in determination of optimal level of cash of a company. According to this model optimal level of cash balance is one at which cost of carrying the inventory of cash and cost of going to the market for satisfying cash requirements is minimum. The carrying cost of holding cash refers to the interest foregone on marketable securities where as cost of giving to the market means cost of liquidating marketable securities in cash.

Optimum level of cash balance can be determined as follows:

$$Q = \sqrt{\frac{2AO}{C}}$$

Where Q = Optimum level of cash

A= Total amount of transaction demand

O= Average fixed cost of securing cash from the market (transaction cost)

C= Cost of carrying cash, i.e., interest rate on marketable securities for the period involved.

Assumptions: The model is based on the following assumptions:

(i) The demand for cash, transactions costs of obtaining cash and the holding costs for a particular period are given and do not change during that period.

(ii) There is a constant demand for cash during the period under consideration.

(iii) Cash payments are predictable

(iv) Banks do not impose any restrictions on firms with respect of maintenance of minimum cash balances in the bank accounts.

b) Stochastic (Miller-Orr) Model: The model prescribes two control limits, Upper control Limit (UCL) and Lower Control Limit (LCL). when the cash balances reaches the upper limit a transfer of cash to investment account should be made and when cash balances reach the lower point a portion of securities constituting investment account of the company should be liquidated to return the cash balances to its return point. The control limits are converting securities into cash and the vice - versa, and the cost carrying stock of cash.

The "O" optimal point of cash balance is determined by using the formula

$$O = \sqrt[3]{\frac{2TV}{4I}}$$

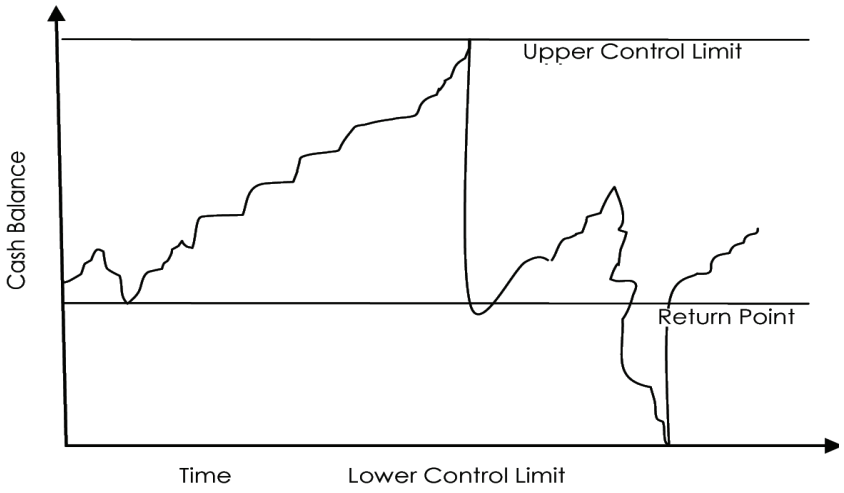
Where,

O = Target cash balance (Optimal cash balance)

T = Fixed cost associated with security transactions

I = Interest per day on marketable securities

V = Variance of daily net cash flows.



Limitations: This model is subjected to some practical problems

(i) The first and important problem is in respect of collection of accurate data about transfer costs, holding costs, number of transfers and expected average cash balance.

(ii) The cost of time devoted by financial managers in dealing with the transfers of cash to securities and vice versa.

(iii) The model does not take into account the short term borrowings as an alternative to selling of marketable securities when cash balance reaches lower limit.

Besides the practical difficulties in the application of the model, the model helps in providing more, better and quicker information for management of cash. It was observed that the model produced considerable cost savings in the real life situations.

c) Probability Model

According to this model, a Finance Manager has to estimate probabilistic out comes for net cash flows on the

basis of his prior knowledge and experience. He has to determine what is the operating cash balance for a given period, what is the expected net cash flow at the end of the period and what is the probability of occurrence of this expected closing net cash flows.

The optimum cash balance at the beginning of the planning period is determined with the help of the probability distribution of net cash flows. Cost of cash shortages, opportunity cost of holding cash balances and the transaction cost.

Assumptions:

(i) Cash is invested in marketable securities at the end of the planning period say a week or a month.

(ii) Cash inflows take place continuously throughout the planning period.

(iii) Cash inflows are of different sizes.

(iv) Cash inflows are not fully controllable by the management of firm.

(v) Sale of marketable securities and other short term investments will be effected at the end of the planning period.

The probability model prescribed the decision rule for the Finance Manager that he should go on investing in marketable securities from the opening cash balance until the expectation, that the ending cash balance will be below the optimum cash balance, where the ratio of the incremental net return per rupee of investment is equal to the incremental shortage cost per rupee.

III) Strategy for economizing cash: Once cash flow projections are made and appropriate cash balances are established, the finance manager should take steps towards effective utilization of available cash resources. A number of strategies have to be developed for this purpose. They are:

(α) Strategy towards accelerating cash inflows and

(β) Strategy towards decelerating cash outflows

(α) **Strategy towards accelerating cash inflows**: In order to accelerate the cash inflows and maximize the available cash the firm has to employ several methods such as reduce the time lag between the moment a payment to the company is mailed and the moment the funds are ready for redeployment by the company. This includes the quick deposit of customer's cheques, establishing collection centers and lock – box system etc.

(b) **Strategy for slowing cash outflows**: In order to accelerate cash availability in the company, Finance Manager must employ some devices that could slow down the speed of payments outward in addition to accelerating collections. The methods of slowing down disbursements are as follows:

(i) Delaying outward payment;

(ii) Making pay roll periods less frequent;

(iii) Solving disbursement by use of drafts;

(iv) Playing the float;

(v) Centralised payment system;

(vi) By transferring funds from one bank to another bank firm can maximize its cash turnover.

Illustration 1

United Industries Ltd. projects that cash outlays of ₹ 37,50,000 will occur uniformly throughout the coming year. United plans to meet its cash requirements by periodically selling marketable securities from its portfolio. The firm's marketable securities are invested to earn 12% and the cost per transaction of converting securities to cash is ₹ 40.

(α) Use the Baumol Model to determine the optimal transaction size of marketable securities to cash.

(β) What will be the company's average cash balance?

(χ) How many transfers per year will be required?

(δ) What will be the total annual cost of maintaining cash balances?

Solution:

(α) Optimal size = $\sqrt{2TA/I} = \sqrt{(2\times 40\times 37,50,000)/0.12}$ = 50,000

(β)	Average cash balance	= ₹ 25,000
(χ)	No of transactions per year = 37,50,000/50,000	= 75
(δ)	Total annual cost	
(ε)	Transaction cost 75 x 40	= 3,000
(ϕ)	Opportunity cost 50,000 x 1/2 x 12%	= 3,000
		6,000

Illustration 2

The Cyberglobe Company has experienced a stochastic demand for its product. With the result that cash balances fluctuate randomly. The standard deviation of daily net cash flows is ₹1,000, The company wants to impose upper and lower bound control limits for conversion of cash into marketable securities and vice-versa. The current interest rate on marketable securities is 6%. The fixed cost associated with each transfer is ₹1,000 and minimum cash balance to be maintained is ₹10,000.

Compute the upper and lower limits.

Solution:

Standard Deviation = 1,000

Variance = 1,000 x 1,000 = 10,00,000

Interest = 6% / 365 = 0.016%

T = 1,000

L = 10,000

$Z = 3\sqrt{(3TV / 4I)}$

$= 3\sqrt{(3\times1,000\times1,000\times1,000) / (4\times0.016\%)}$

= 3,573

Return point = Z + L

→ 3573 + 10000 = 13573

Upper limit = 3R -2L

→ 40719 - 20000 = 20719

Economic Order Quantity: (EOQ)

The total costs of a material usually consist of Buying Cost + Total Ordering Cost + Total Carrying Cost. Economic Order Quantity is 'The size of the order for which both ordering and carrying cost are minimum'. Ordering Cost: The costs which are associated with the ordering of material. It includes cost of staff posted for ordering of goods, expenses incurred on transportation, inspection expenses of incoming material....etc

Carrying Cost: The costs for holding the inventories. It includes the cost of capital invested in inventories. Cost of storage, Insurance.....etc

The assumptions underlying the Economic Ordering Quantity (EOQ): The calculation of economic order of material to be purchased is subject to the following assumptions:-

(a) Ordering cost per order and carrying cost per unit per annum are known and they are fixed.

(b) Anticipated usage of material in units is known.

(c) Cost per unit of the material is constant and is known as well.

(d) The quantity of material ordered is received immediately i.e lead time is Zero.

The famous mathematician 'WILSON' derived the formula used for determining the size of order for each purchases at minimum ordering and carrying costs, which is as below :-

Economic Ordering Quantity = $\sqrt{\frac{2AO}{C}}$

Where,

A = Annual demand /Consumption

O = Ordering Cost per order

C = Carrying Cost per unit per annum.

Graphical representation of EOQ:

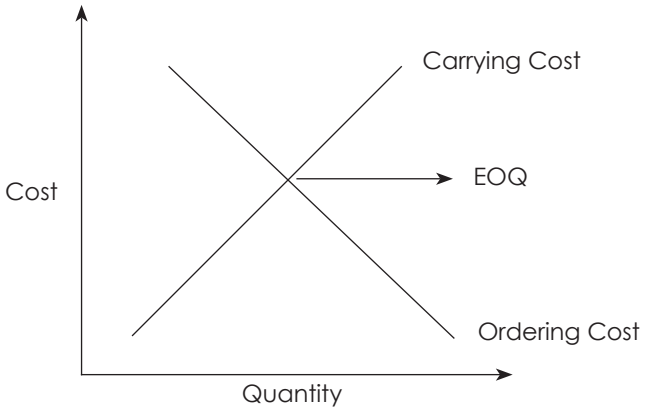


Illustration 1

Calculate the Economic Order Quantity from the following information. Also state the number of orders to be placed in a year.

Consumption of materials per annum		:	10,000 kg
Order placing cost per order	:	₹ 50	
Cost per kg. of raw materials	:	₹ 2	
Storage costs		:	8% on average inventory

Solution:

EOQ = $\sqrt{\frac{2 \times A \times O}{C}}$

A = Units consumed during year = 10,000 Kg.

O = Order cost per order = ₹50

C = Inventory carrying cost per unit per annum 2 × 8% = ₹ 0.16

EOQ = $\sqrt{\frac{2 \times 10,000 \text{ (units)} \times ₹ 50}{₹ 0.16}}$

EOQ = 2,500 kg.

$$\text{No. of orders to be placed in a year} = \frac{\text{Total consumption of materials per annum}}{\text{EOQ}}$$

$$= \frac{10{,}000 \text{ kg}}{2{,}500 \text{ kg}}$$

= 4 Orders per year

Illustration 2

The average annual consumption of a material is 18,250 units at a price of ₹ 36.50 per unit. The storage cost is 20% on an average inventory and the cost of placing an order is ₹ 50. How much quantity is to be purchased at a time?

Solution:

$$\text{EOQ} = \sqrt{\frac{2 \times 18{,}250 \text{ (units)} \times ₹\ 50}{20\% \text{ of } ₹\ 36.50}}$$

$$= \sqrt{\frac{18{,}25{,}000}{7.3}}$$

= 500 Units

16 PERFORMANCE MANAGEMENT

Definition

Performance management is a process for setting goals and regularly checking progress toward achieving those goals. It includes activities that ensure organizational goals are consistently met in an effective and efficient manner. The overall goal of performance management is to ensure that an organization and its subsystems (processes, departments, teams, etc.), are optimally working together to achieve the results desired by the organization. Performance management has a wide variety of applications, such as, staff performance, business performance, or in health care, health outcome performance measures

Therefore Performance management includes the way managers evaluate employees, how employees evaluate their managers and fellow employees, and how individual workers evaluate themselves. The ultimate goal of performance management is to improve the quality of work in the most efficient manner possible.

Importance

An effective performance management system can play a very crucial role in managing the performance in an organization. In short, it can be described as a comprehensive process starting from monitoring and developing the desired traits to rating their progress and rewarding them for their achievements. Performance Management is critical to Workforce Planning.

Managing employees' performance can increase an organization's competitiveness and maximize its productivity. Not only that, it can also increase morale and create stronger teams and propel top performers onto successful careers. All stakeholders in an organization stand to gain from the implementation of a performance management system as follows.

Higher Productivity: Performance management systems are designed to keep employees and organizations functioning at their optimum level, with the net result of the system being that employees are able to produce more, because they have the proper training and are the right fit for their jobs. Employees who have career paths, which is a facet of performance management, have a vested interest in seeing their team members and department succeed. As a result, productivity is increased.

Employee Advancement: Top performers within an organization deserve to advance when the opportunity arises. Performance management systems help human resources personnel and department leaders identify top-rated employees and develop them for the next step in their careers. Without a process to identify top performers, talented individuals can get stuck in jobs beneath their skill level and end up quitting as a result. Also, coaching for improved performance is a major part of performance management and can help employees overcome their shortcomings, so they can advance their careers and strengthen their organization.

Higher-Quality Products & Services: Employees who are properly screened, trained and coached have a propensity to create higher-quality products and services. This is because they have the proper skills and care about their jobs enough to perform them properly, while at the same time looking for new and innovative ways to remove waste from their processes and systems. Delays, rework, excess transportation and overproduction are all kept to a minimum when a performance management system is implemented. This includes on the production floor and in administrative offices.

Corrective Action & Terminations: Performance management systems have corrective action procedures, which can help personnel correct deficient behavior in a quick and professional manner. There are also defined guidelines for employee termination, making it easier for employers to obey the law when they terminate an

employee. A system of corrective action steps can make it easier for employers and managers to adjust their coaching techniques to better lead their personnel, too. Without this facet of performance management, easily correctable behavior could lead to terminations.

Performance Management Process

The performance management process is dependent on the needs of an organisation and the purpose it is supposed to serve. Performance management systems can support decisions such as those on employee remuneration, promotions, development and reductions in the workforce. However, Pulakos (2004) warns that a performance management system that attempts to achieve too many objectives is likely to fail due to a lack of focus. While performance management systems can be used for decision making and employee development, these two objectives are rarely supported by a single system. Based on examinations of several organisations, Pulakos (2004) provides a model of a typical performance management process, as shown in the following figure (Figure 1.2)

Figure 1.2: Performance management process (Pulakos, 2004)

The relationship between performance related human resources management (HRM) practice and organisational performance shows that HRM practices are typically expected to increase employee organisational commitment and motivation, which in turn affects employee performance and ultimately organisational performance.The conceptual model by Hartog, Boselie and Paauwe (2004) presented in Figure 1.3 shows an impact of the aligned set of HRM practices in performance management system on employee perceptions and attitudes. The model proposes that front-line managers play a crucial role in implementing these sets of practices. It was also highlighted that employee perceptions and attitudes affect employee performance, which in turn affects organisational performance (Hartog et al., 2004).

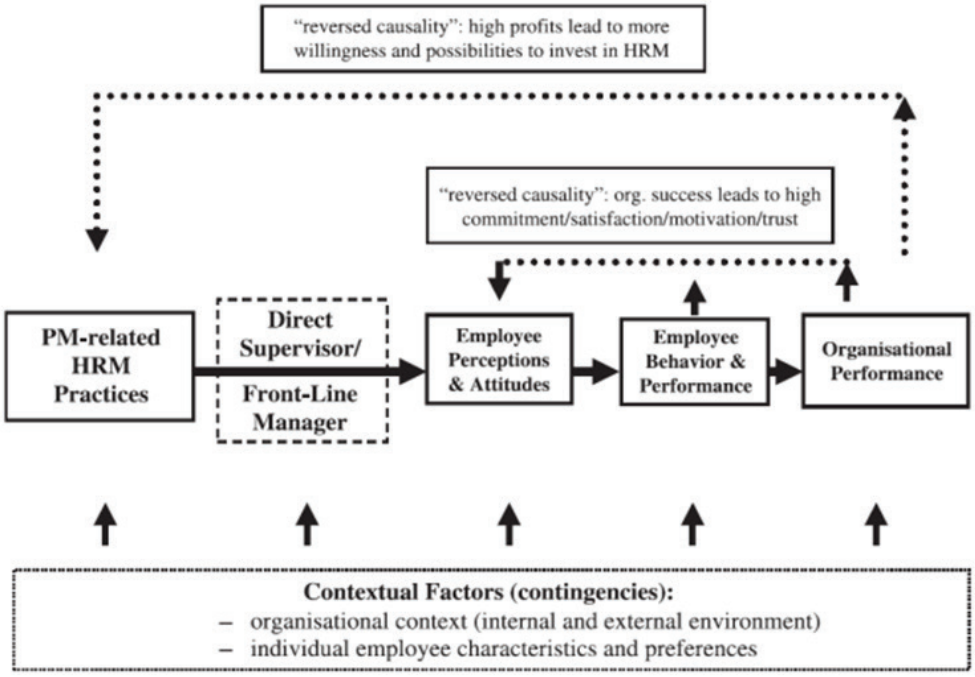


Figure 1.3: A model of HRM and performance relationship from a PM Perspective (Hartog et al., 2004)

Critical Success Factors in Performance Management

Critical success factors are defined as a group of indispensable activities or elements that enable an organisation to achieve its stated objectives, thereby ensuring the successful performance of both current and future operations (Rothberg & Morrison, 2012). Skrinjar and Trkman (2013) define critical success factors as those activities and processes that are designed to support the achievement of desired outcomes, as specified by the. organisation's objectives or goals and, as such, provide organisations with the greatest competitive leverage upon which resources should be focused. A number of research reports highlight several conditions for success for performance management (Chubb, Reilly & Brown, 2011; Haines & St-Onge, 2011; Trkman, 2010; Ariyachandra & Frolick, 2008). Among the most common measures applied to improve the effectiveness of performance management systems are simplification and the use of competencies (Chubb et al., 2011). In addition to these measures, there is also a need to integrate the performance management process with the culture of an organisation and tailor the process to the varying needs of different employees.

CONCLUSION

Performance management systems are mechanisms of reviewing employee performance including their behavior and expected achievement during a rating cycle. However, the effectiveness of performance management systems in many organisations remains poor. Both managers and employees report a lack of candid appraisals due to the personal nature of the feedback to be given. Studies indicate that there are contextual variables that influence the effectiveness of performance management.

17 APPENDIX : ENGINEERS AND QUALITY MANAGEMENT

The engineering profession has evolved in a dramatic way over the past few years. Indeed, engineers are no longer confined to fulfilling specific tasks of a support nature only. Their involvement is much more encompassing and they tend to assume much broader roles with higher organisational objectives. They manage technological systems, resources and projects and contribute substantially by adding value to organisational performance. To understand the relevance of TQM to engineers, it is perhaps important to spend time discussing the evolution in the engineering profession which has brought its practitioners to the centre of business activities.

Engineers have in the past, been a difficult group to consider. They did not fit easily into the categories provided by occupational status, the power of decision-making, the visible contributions towards productivity and profitability improvements and the privileges of association and contact with power providers.

Cultural snobbery has also added little credibility to the engineering profession and its uptake as a career in academic establishments. It has often been described as dealing with 'nuts and bolts' and regarded as perhaps not much different from the contribution of semi-skilled workers and shopfloor workers generally.

It is therefore not surprising that the engineering profession for a number of years has not increased in status within organisations and has not gained any further recognition or encouragement from society as a whole.

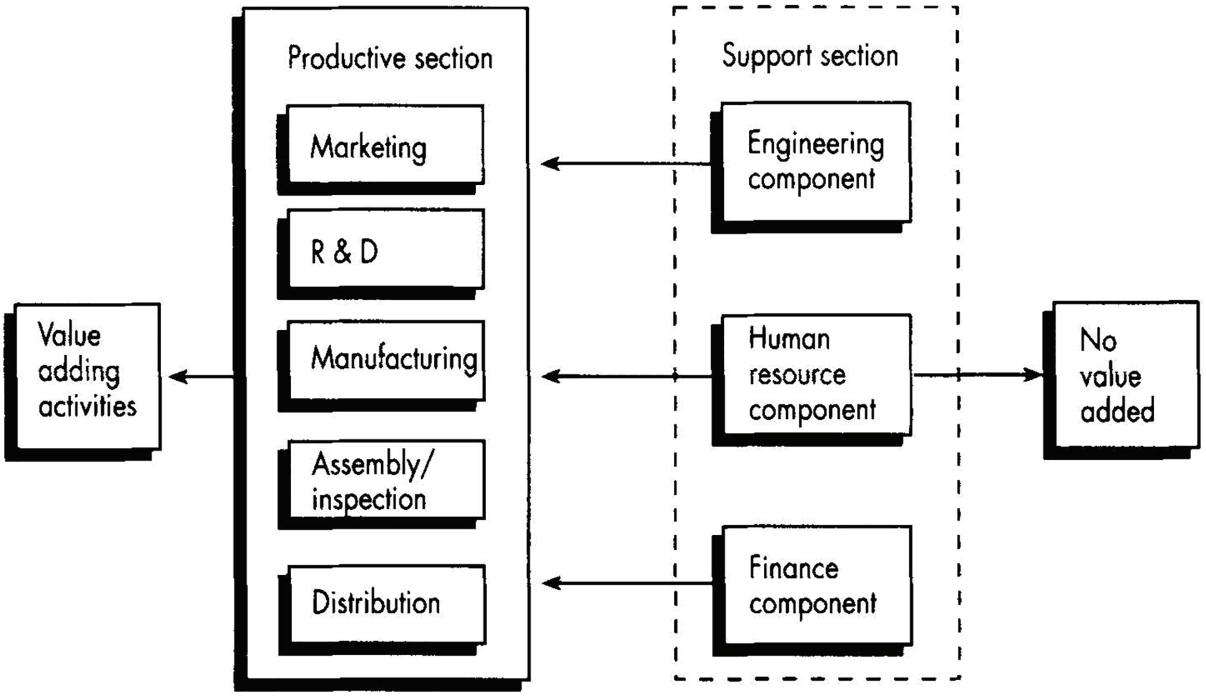
The traumatic experiences suffered by most Western economies in the face of the competitive excellence of Japanese businesses have raised many questions on routines and old habits, particularly the role of the manufacturing function and how various tasks including those of engineers are to be redefined.

It is with this new role of engineers in mind that this chapter seeks to establish the link between the preachings of TQM and the expected role of engineers in fulfilling the required organisational objectives.

The chapter distinguishes between the traditional role of engineers as a support group to the highly valued visible contributing functions, and a new role based on integrated activities with other functions and with more visible contributions towards internal efficiency and competitiveness in the outside market.

THE ENGINEER AS SPECIALIST

Engineering as a specialist profession has been perceived as no more than a support function which is not encouraged to contribute directly in adding value to organisational functions. The model represented in Fig. 1.1 shows the traditional view of the engineering function as a 'Non Value Adding' activity, similar to the role of personnel and finance. These functions have always been described as providing technical/legal/commercial advice and guidance without necessarily being able to influence the decision-making process.



The role of engineering in the traditional organisational systems model.

The message which emerges from Figxl.1 is that an enclosure has been deliberately put around the engineering function to keep it as a separate component from the other functions regarded as the lifeblood of organisations. This suggests that the partitioning of the various functions and their compartmentalisation is not necessarily an infrastructural problem but one more embedded in attitudes and beliefs towards the role of engineering in industry.

The concerns over the narrowly defined role of engineers and their specialisation are widely spread. The lessons learnt from the Japanese competitors have drawn attention to the urgent need to produce knowledge workers with organisational awareness of objectives and direction. Various terminologies have been used to help redefine the role of engineers, such as 'an integrated role' and 'a systems role' amongst others.

The need to shift away from a narrowly defined role with task oriented objectives towards a more integrated role which contributes towards productivity improvements within organisations, can perhaps be expressed by the following comments.

> *'Our whole society is based on individualism, specialisation and entrepreneurial skills. This impedes our ability to develop an integrated inter-disciplinary team approach dedicated to optimise the whole endeavour, not its specific parts. This requires not only a broad-based technical knowledge but also business, financial and sociological acumen as well.'*

THE FAILURE OF ENGINEERING EDUCATIONAL SYSTEMS: THE UK EXPERIENCE

The failure of manufacturing industry in the UK in not sustaining its strength to compete in world markets has been linked to a variety of factors including the weak role of academic institutions in not providing skills which could have enabled industrialists to compete more positively. In Britain, for example, engineering educational institutions have been blamed for their rigidity and steady-state approach towards evolution and changes in the industrial world.

Educational systems in the UK have tended to place more focus on the production of specialists in the areas of mechanical engineering, production engineering, chemical engineering, control engineering, electrical engineering, electronic engineering and aeronautical engineering.

The 'A' level curriculum in the UK has been described as a limited pool, offering narrow options to graduates (three subjects) in comparison to seven subjects in other European programmes. In terms of the quantity of graduates in engineering in comparison to pure scientists Table-1 shows that Britain is lagging behind when compared with Japan.

Table 1 : A comparison of graduate number between UK and Japan

Specialist options	Britain	Japan
Engieering graduates per annum	12,000	70,000
Pure science gruduates per annum	22,000	10,500

These figures, albeit simplistic, indicate that there is a difference in emphasis on the engineering profession in comparison with the need for pure scientists between Japan and the UK. To highlight further the shortcomings of the British engineering educational system, reference has to be made to an important research project which was specifically conducted to assess the quality, suitability and effectiveness of existing educational systems and the various engineering options they provide.

The 'Goals of Engineering Education Project' (GEEP)9 was commissioned by the Council for National Academic Awards (CNAA) and the Department of Education and Science and carried out by the School of Electronic and Electrical Engineering at Leicester Polytechnic. GEEP conducted in-depth interviews with 250 mechanical, electrical and electronics graduates in 55 public and private organisations. The project also conducted interviews with 200 people with or for whom engineers worked.

The report concluded that the present British engineering educational system is rigid, inflexible and does not prepare engineers well enough to attain promotions and career development within organisations. The report goes on to say that:

> *'It is no surprise then to observe that the profession appears fragmented and that engineers appear to lack the will to do anything about this themselves. Though formally described as a professional, these findings suggest that the engineer is usually treated more like a technician, a hired hand, who performs a technical task without comment, and without expecting to or being expected to comment.'*

Table 2 lists extracts from some key comments made by the different respondents of the GEEP report.

THE NEW BREED OF ENGINEERS

The modern competitive nature of organisations has placed more emphasis on integrated roles and the ability to manage projects on a cross-functional basis. This is considered to be necessary for linking organisational internal strengths to the competitive market externally.

As far as engineers are concerned, their role has been broadened to cover aspects of organisational competitiveness. Macro-engineering awareness is perceived to be the element of their education/training which will enable them to understand how large systems operate including people processes, machine processes, market behaviours, suppliers, etc. Micro-engineering awareness consists mainly of their detailed engineering knowledge about the operation and design of technical processes (electromechanical systems, processing systems and computer aided engineering systems).10

Who are the new engineers?

Engineers have so far been described in broad terms without specifically referring to the nature of their education and training or their place within organisations. The new breed of engineers with broader education has been described in various ways such as manufacturing engineers, systems engineers or industrial engineers.

Manufacturing engineers

Manufacturing engineering is considered to be the integration of industrial engineering with electrical engineering, mechanical engineering and computer science, with the addition of business and finance.

Table 1.2 The engineer and business requirements

Need for a broad education	It is effective to use engineers with a multidisciplinary background They need new tools because jobs and technologies change Engineers are inflexible, unadaptable, convergent thinkers A broad technical education is valuable because it presents different views
Ability to communicate	One of an engineer's biggest failures is the inability to communicate Widespread literacy rather than a course of communications is the answer Education should teach how to argue Communications are as important as engineering

Knowledge of the business context	Ignorance is fuelled by reluctance Engineers are an insular breed who consider it unnecessary to be concerned with the profitability and efficiency of the organisation as a whole Engineers are reluctant to justify costs as it is seen as questioning their expertise Engineers have had no training in alternatives. They are keen to see things relating immediately to their jobs, but are not keen on peripheral aspects, e.g. budgeting
Engineers and the decision making process	There is a tendency to insulate engineers from non-technical issues, yet these are areas of key importance Engineers are not allowed to manage - others make decisions for them Engineering is not viewed as an integral part of management There is an enormous gap between engineers' knowledge and that of the company

Systems engineers

Systems engineers are those people concerned with the design, commissioning and operation of:

- Machine systems (minis, micros, instruments, machines, processes);
- Computer aided engineering support systems (CAD/CAM);
- Manufacturing systems (integrated assemblies of computers, people organisations, systems, market interfaces and business planning system interfaces).

Industrial engineering

The industrial engineer (IE) is sometimes referred to as the integrated engineer as the nature of the training is broad, giving general knowledge on methodology, people systems, problem solving approaches, innovativeness and the ability to link designs, products and manufacturing processes as an integrated system.

There is however a more formal definition given by the Institute of Industrial Engineers Terminology Handbook. This refers to industrial engineering as follows:

> *'Industrial engineering - concerned with the design, improvement and installation of integrated systems of people, materials, equipment and energy. It draws upon specialised knowledge and skills in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design, to specify, predict and evaluate the results to be obtained from such systems.'*

The various definitions given above all refer to the integration of technical systems with organisational objectives and people systems. The role of engineers is seen to be pertinent in facilitating the integration of technical processes to other aspects of organisational systems with productivity improvement very much in mind and with the ability to channel 'inputs' for maximising performance, aided by the ability to measure and control performance.

The engineer as manager

It is often considered that engineers tend to aspire to a career in management once they have progressed well enough in their jobs.22 Others have discussed the need to equip engineers with the tools and organisational knowledge to help them solve a variety of problems-1 and the need to have engineers as part of the 'product-realisation process' to create goods and services that will generate wealth.5 It is also thought that as it is predicted that future competitiveness of organisations will more and more emphasise project teams and matrix structures, the progression of engineers to management jobs in manufacturing will become the norm.21

The transition of an engineering specialist from a technical role to a managerial role leads to a dramatic change in time utilisation as far as skills and knowledge are concerned. It is expected that at least 85% of the time of an engineer is spent dealing with technical aspects of his or her job. This pattern is however reversed when promotion to a managerial job takes place. 60% of a manager's job is spent making decisions and only 30% on technical matters. Managers are however expected to understand some broad concepts of the technical aspects of the operation processes they are in charge of, Fig. 1

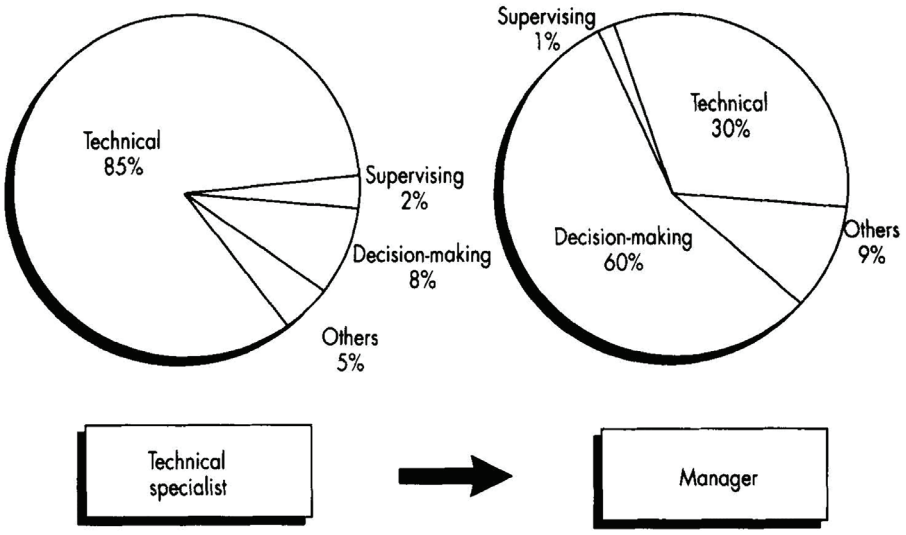
There are various descriptions which have been given to the expanding role of engineers. These refer to the involvement of engineers in the decision making process and in the achievement of organisational objectives.

The following role descriptions are a good example of how an engineer is considered in an organisational system based on modern competitive approaches.

Role description 1

This example describes engineers as people who will undergo the following transitional process:

2. From engineers to managers: a growing role.



Step 1 Technical specialist: An individual with practical and technical training and or/experience in a given field;

Step 2 Project manager: An individual assigned the direct responsibility of supervising a given project through the phases of planning, organising, scheduling, monitoring and controlling;

Step 3 Group manager: An individual who is assigned direct responsibility to plan, organise and direct the activities of a group with a standing charge;

Step 4 Director: An individual who oversees a particular function of the organisation. This is a critical responsibility that directly affects the welfare of the organisation;

Step 5 Administrative manager: An individual who oversees the administrative functions and staff of the organisation. Responsibilities cut across several functional areas and he/she therefore must have proven managerial skills and diversity in previous assignments.

Role description 2

This model is proposed for the new breed of engineers who have to cope in a highly automated and technologically advanced environment.

System integrator: The abilities necessary to ensure that the components of technology based systems in a production environment are fully integrated. This integration task could involve co-ordinating the activities of individuals, groups, vendors and projects;

Communicator: The communication skills and abilities required to develop effective communication within the organisation. The total production process performance is communicated to everyone through a manual or system-oriented channel;

Designer of systems/organisations: Knowledge of systems and methods used to design operating systems and organisation structures;

Problem-solver: Competence in the techniques of problem solving analysis and solution, ability to diagnose problems and resolve them to improve productivity and quality levels, and ensure organisational effectiveness;

Innovator: Creative judgement to maximise the effective utilisation of organisational resources. Productivity improvement techniques are applied to reduce the total cost of doing business in a high technology production environment;

Advocate and decision maker: On-going assessment and thorough understanding of the high technology

production process. Knowledge of social sciences and behavioural characteristics are used for negotiation, consensus building, teamwork, acceptance criteria and action implementation in decision making;

Planner of integrated systems requirements: Knowledge of budget and control to manage the financial requirements in the high technology arena. Alternative methods and techniques for improving the effectiveness of decision making are also planned for both short and long term;

Teacher and a model style: Behavioural knowledge to influence and improve morale and motivation in the high technology environment. Coaching and negotiation skills used to help peers, superiors and subordinates in overcoming obstacles to productivity and total system effectiveness;

Change master: Acceptance leader, structured group process provider, teacher, skill developer, facilitator, data gatherer, collaborator, team member, team leader, situational leader, challenger, participative management system designer, catalyst and design team leader.

Role description 3

This model suggests that the enlarged role of engineers has to consist of conceiving, designing, implementing and operating more sophisticated manufacturing systems.21 This new managerial role is expected to be affected by the following factors:

1. Need to deploy other skills beyond technical skills, such as computing, control, materials handling;
2. Need to design integrated systems consisting of interdependent processes rather than specifically concerned with particular tasks;
3. Need to work alongside, and refer to, other specialists and to co-ordinate all the various efforts;
4. Need to operate as project teams in the form of a matrix organisation;
5. The need to act in a 'continuity' role within project teams for the purpose of fulfilling organisational objectives rather than for the achievement of specific tasks;
6. Need to take account of a business perspective in the execution of various roles with the accommodation of labour and financial implications.

Role description 4

This model can be described in two parts which relate to the evolution in the career of an engineer from a technical aspect to a broader and managerial aspect. 14~18

Requirements for manufacturing systems engineers: Skills and knowledge requirements in the areas of business and market strategy, process engineering, production engineering including design for packaging, control engineering and instrumentation, systems analysis, computing and information systems design, human relations, methodologies of manufacturing systems design related to range of industry types, organisation and job design, factory systems economics.

Requirements for business systems engineers: Business systems engineers are multidisciplinary engineers and have knowledge and expertise in the following areas - finance and accounting, business systems studies, strategic planning, human relations and information technology. They also need a good understanding of manufacturing systems.

There is little to distinguish between the various descriptions provided. They all highlight the need for a managerial role for engineers, by moving from purely technical skills/knowlege oriented role to a broader organisational role which encompasses additional skills/knowledge in behavioural sciences, communication, financial and strategic competences.

ENGINEERS' COMPETENCES AND THE ROLE OF TOM

TQM basically advocates the introduction and practice of a new culture. This is to be based on waste removal, maximising organisations' effectiveness and encouraging a process of innovativeness and adding value by problem solving activities. This process is encouraged by people interactions at different levels and continuous and effective communication processes which try to relay continually the need to focus on organisational objectives.

This chapter has so far tried to explain the reasons why engineers have to develop, grow and move away from a traditional culture which encourages specialism and individualistic contributions, towards a new approach based on a broader role. This role is meant to reflect the importance of considering organisations as total systems and the need to work across boundaries to achieve the objectives which will decide on the future existence of the organisations concerned.

One can see that there is a high degree of compatibility between what TQM tries to preach as a philosophy of modern competitiveness, and how the new role of engineers can fit in this scenario. The slogans such as 'world class manufacturers', 'market leaders', 'competitive organisations' are not self-advertised labels but statements which recognise the degree of success, vigour, health, progressiveness and determination that businesses such as Japanese manufacturers have earned themselves through best practice and a dedication to TQM.

THE EVOLUTION OF ENGINEERS FOR TOM

The evolution in the role of engineers was initiated by the developments and changes which took place in manufacturing industry itself. Manufacturing industry has evolved from an era which used to rely on heavy demand and people intensive processes to produce large volume and low variety products (mass production era of 1960s). The introduction of automated systems in the 1970s in the form of CNC machines and automated materials handling systems has led to more reliance on highly skilled labour and a more disciplined approach towards new product development using electronics. The 1980s is perhaps the era where marketing has emerged as the leading function in organisational systems dictating types and levels of competitiveness. This era was marked by an intensive process of introducing technological innovations both for manufacturing operations purposes and also for new product development processes (use of 3D CAD systems).

It appears that the 1990s competitive set-up is going to be heavily influenced by customer input, customer power and customer choice. It is becoming widely accepted that organisational systems have got to be more flexible to react to customer demands. They have to reduce lead times considerably and have to cut down constantly on waste and add value to customer services. The use of CAD systems linked to Computer Aided Manufacturing (CAM) systems to relate customer requirements to organisational ability to meet those requirements, and the introduction of Just In Time (JIT) philosophy and the Focused Factory approach are not accidental, Table 3.

Tdble 3 Changes in the manufacturing environment

	1960s	**1970s**	**1980s**	**1990s**
Driving force	Markets	Finance	Marketing and technological innovation	Customer power
Product development process	Incremental changes Based on experience and using simple tools	Some use of electronic power, still reliance on drafting tools	Heavy use of electronic power 3D-CAD systems	CAD systems and heavy involvement of customers
Role of manufacturing function	Mass production People intensive processes Low/ basic skills	Automated systems (NQCNC) Material handling/ assembly systems	Flexibility in automated systems Integrated manufacturing systems Computer controlled processes	Focused factory JIT philosophy Quality and productivity orientation
Role of manufacturing engineers	Traditionally skills based	Skills based and knowledge based	Knowledge based with use of computer power (systems approach)	Systems approach and integrated knowledge based role in project management form

It is the desire to achieve customer satisfaction at all levels which has prompted organisations to look more closely at the benefits of TQM and its importance as a strategy for survival, health and prosperity. The Focused Factory approach is about having slimmer manufacturing processes which are of high flexibility and capability to produce to customer specifications. The introduction of JIT philosophy aims to eliminate waste, reduce lead time and optimise efficiency levels. The use of powerful 3D CAD systems aims to design to precise customer specifications.

This new approach towards modern competitiveness using TQM as the major disciplining force to achieve the desired objectives has wider implications on people systems including the role of the engineer as has been discussed previously. The role of manufacturing engineers has evolved in parallel with evolutions in organisational systems and the relevant technological processes introduced. The engineer has become more of a knowledge based worker using powerful tools such as computers to design, implement, monitor and control and predict the performance of various sub-systems. Under the umbrella of TQM, the engineer has been developed to take

a systems approach for organisational objectives and to use an integrated and broader knowledge based on participating in project management tasks.

The evolution of the role of the engineer towards an ability to fulfill tasks and contribute to problem solving, eliminating waste, adding value, being innovative and being committed towards organisational objectives can be described by the following three models.

Model 1: The basic support perspective

- The organisation is usually formal and departmentalised in its structure;
- The product line is usually well established or complex;
- A fairly strong 'we-they' stigma often exists;
- This traditional style of management has little commitment towards employee development programmes or seldom encourages participative management to be introduced.

Model 2: The multiple resource perspective

- Genuine commitment to employee involvement at the plant management level, and often at the corporate level;
- This culture in turn dictates much of the organisational philosophy;
- The company is more decentralised, and exhibits a defined planning process under which goals and objectives are regularly established for individuals and the company as a whole;
- An awareness of employee needs also represents a more progressive style of management.

Model 3: The total involvement perspective

- A family approach to doing business shows that the participative culture is a way of life in the company;
- The product line is stable and/or simple in design;
- Corporate support and funding is found at all organisational levels;
- A participative mentality is a pre-requisite for employment.

Although the three models above do not depict clear pictures about management styles and types of organisational structures one can deduct that the spirit of employee involvement and full participation for the achievement of organisational objectives can only grow if there is clear commitment from all parties especially those who have the duty to ensure the success of their organisations. TQM is the discipline which will determine the likelihood of organisational objectives turning into reality.

THE ENGINEER IN A TQM ENVIRONMENT

Organisational systems under TQM consist of a series of subprocesses which can use inputs to convert them to outputs and which, in turn, become inputs themselves for a subsequent transformation process. This repeated cycle is meant to supply both internal and external customers. The main aim of the process is to add value continually, and reduce waste and lead time, Fig. 3.

Fig 3 : Intergated model of organisation processes

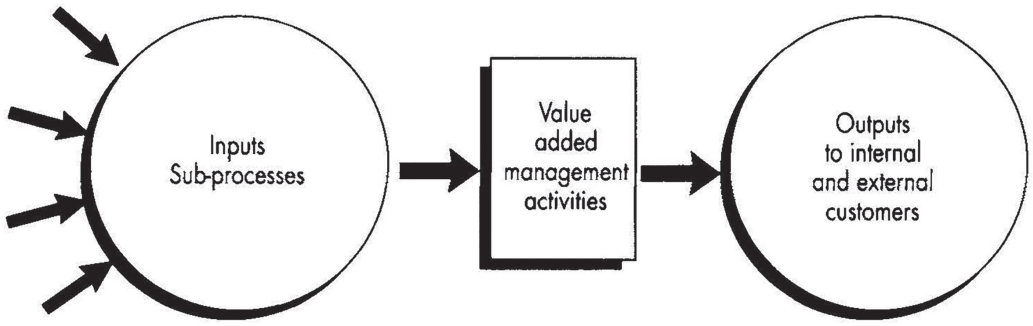
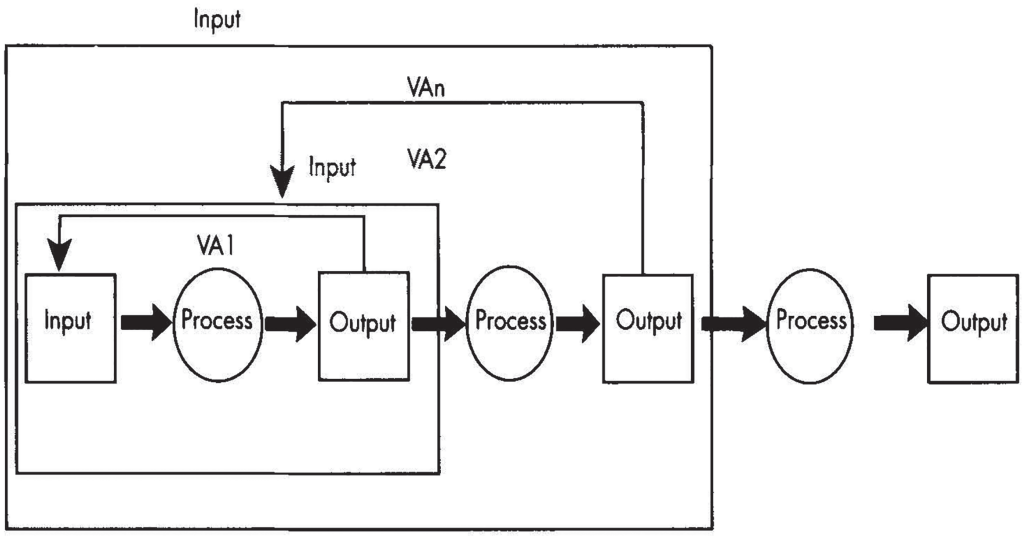


Fig. 4: The propagation cycle for productivity improvement



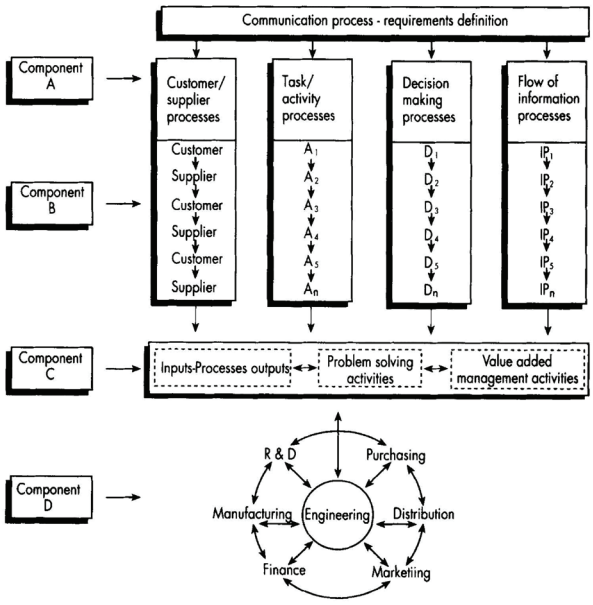
Value Added Management (VAM) therefore is not to be considered as an activity with determined dimensions, timescales and potential. It has to be perceived as a propagated process, Fig. ^.4, where TQM and its preachings become a way of life to change performance levels incrementally and/or radically.

The model in Fig. 5 describes the major elements of organisational systems, which are of a socio-technical nature, by which the dynamic behaviour of organisations is determined.

Component A is a major element in defining and determining the levels of competitiveness and customer needs. It has to result from effective communication inputs and processes and the positive manipulation of information.

Component B consists of a series of subprocesses defining customer-supplier relationships, task/activity processes, decision-making processes and flow of information processes. This component can be defined as 'who owns the problem?'.

Fig. 5: A model of the intergrated role of the engineering function within organisation system



Component C can be described as the 'oven' where the conversion process takes place to produce something of value to the customer both internally and externally. It is fuelled by the continuous input, problem solving activity and the constant desire to improve.

Component D is the 'engine' which keeps the whole system on course and relies on the integrated, supportive, collaborative, innovative, committed, co-ordinated nature of the various functions within it. The integrated approach is adopted for the achievement of a common goal/aspiration. The contribution from the engineering function has to be perceived as part of the total socio-technical process.

CONCLUSIONS

This chapter attempted to answer the questions which have crossed many minds such as 'why is TQM relevant to engineers?' Modern competitive philosophies are affecting cultures and sub-cultures at various levels. It is not just organisations which have to change internally, but also society at large is coming to terms with the wider implications of technological innovation and its impact on job creation/displacement. Educational establishments have to redesign their current curriculae more frequently and are asked to be more innovative in providing skills which industry requires. The concept of customer-supplier under a TQM umbrella will affect most educational establishments supplying skills to industry.

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