

Final Course
(Revised Scheme of Education and Training)
Study Material
(Modules 1 to 3)

PAPER 5

**Strategic Cost Management
and Performance Evaluation**

[Strategic Cost Management and Decision Making]

Module – 1



BOARD OF STUDIES
THE INSTITUTE OF CHARTERED ACCOUNTANTS OF INDIA

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Before we Begin....

Strategic issues are increasingly becoming important, cost management has changed from a traditional role of product costing and operational control to a border, where cost leadership and performance management is vital. In this scenario managing costs strategically and monitoring and controlling performance is crucial for the long-term sustainability of organisations. This study material combines the strategic cost management techniques, with the performance based management framework in one integrated system.

Under the Revised Scheme of Education and Training, at the Final Level, you are expected to not only to *apply* various strategic cost management tools and techniques but also to *analyze* and *evaluate* the issues. The process of learning helps you inculcate the requisite professional skills, necessary for achieving the desired professional competence.

This Study Material is divided into three modules for ease of handling by the students. Module 1 contains Chapters 1-7, Module 2 contains Chapters 8-12 and Module 3 contains Chapter-13. The content for each chapter at the Final level has been structured in the following manner–

- (i) **Learning Outcomes** – Learning outcomes which you need to demonstrate after learning each topic have been detailed in the first page of each chapter. Demonstration of these learning outcomes would help you to achieve the desired level of technical competence.
- (ii) **Chapter Overview** – As the name suggests, this chart/ table would give a broad framework of the contents covered in the chapter.
- (iii) **Content** – Study Material lays greater emphasis on analysis and interpretation of information from the perspective of decision usefulness.
- (iv) **Illustrations and Case Scenarios** have been included in the Study Material systematically, after discussion on each topic, so that application of the concept can be understood very clearly. This would also enable you to learn and sharpen your application skills and test your understanding. Case Scenarios are woven into the text to go beyond the numbers and think critically.
- (v) **Case Studies** based on real-world situations are designed to assess a wider range of skills and integrated learning across the syllabus.

(vi) Let us Recapitulate – A summary of the chapter is given at the end to help you revise what you have learnt. It would especially help you to revise the chapter(s) quickly the day before the examination.

Every effort has been made to make the Study Material error free, however if inadvertently any error is present and found by readers they may send it to us immediately, so that it can be rectified at our end.

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Syllabus

PAPER – 5: STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

(One Paper- Three hours- 100 Marks)

Objectives

- (a) To apply various cost management techniques for planning and controlling performance in order to set, monitor and control strategic objectives.
- (b) To develop skills of analysis, synthesis and evaluation in cost management to address challenges and issues which might affect or influence the management of performance with in organisations

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 - (ii) Limitations of Traditional Cost Management
 - (iii) Traditional vs. Strategic Cost Management
- 2. Modern Business Environment**
 - (i) Introduction/ Characteristics of the Modern Business Environment
 - (ii) Cost of Quality, Total Quality Management, Business Excellence Model
 - (iii) Throughput Accounting and Theory of Constraints
 - (iv) Supply Chain Management (SCM)
 - (v) Gain Sharing Arrangements
 - (vi) Outsourcing

3. Lean System and Innovation

- (i) Introduction to Lean System
 - a) Just-in-Time (JIT)
 - b) Kaizen Costing
 - c) 5 Ss
 - d) Total Productive Maintenance (TPM)
 - e) Cellular Manufacturing/ One-Piece Flow Production Systems
 - f) Six Sigma (SS)
- (ii) Introduction to Process Innovation and Business Process Re-engineering (BPR)

4. Cost Management Techniques

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- (v) Behavioural Aspects of Standard Costing, Limitation of Standard Costing (including its use in the contemporary business environment)

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- (a) Linear Programming
- (b) Learning Curve/ Experience Curve

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INTRODUCTION TO STRATEGIC COST MANAGEMENT



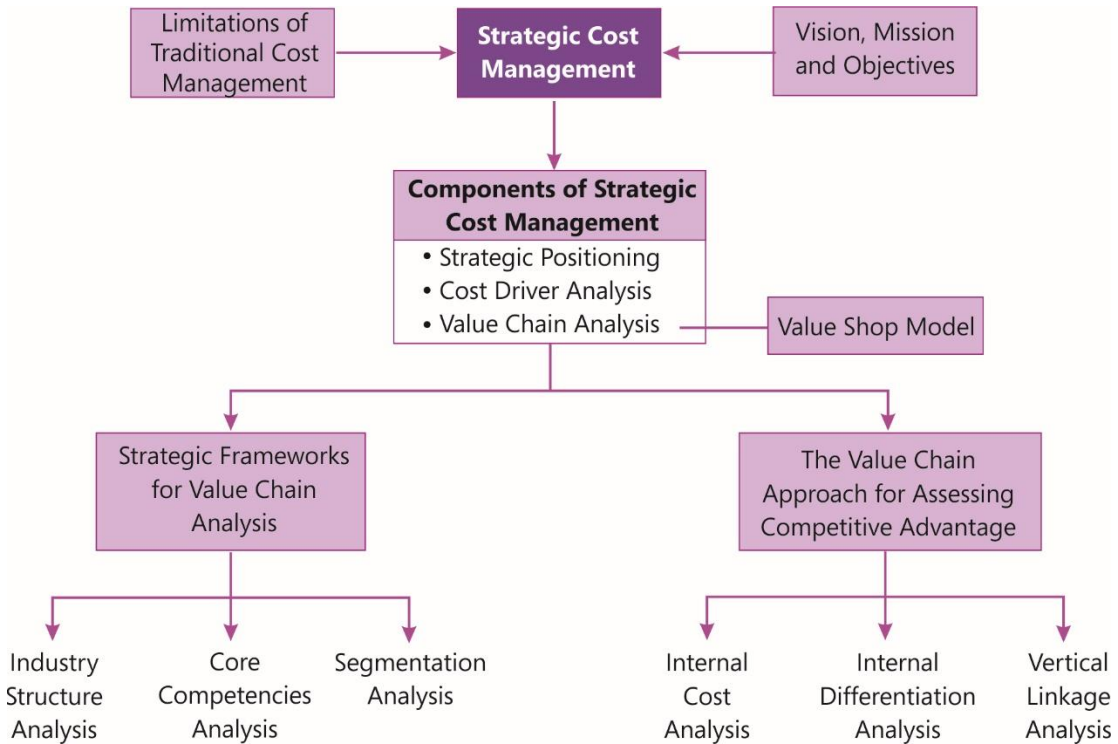
LEARNING OUTCOMES

After studying this chapter, you will be able to:

- ❑ **Explain** the role of Strategic Cost Management in supporting Strategy Development and the Day-to-Day Operations of an organization
- ❑ **Distinguish** Strategic Cost Management with Traditional Cost Management



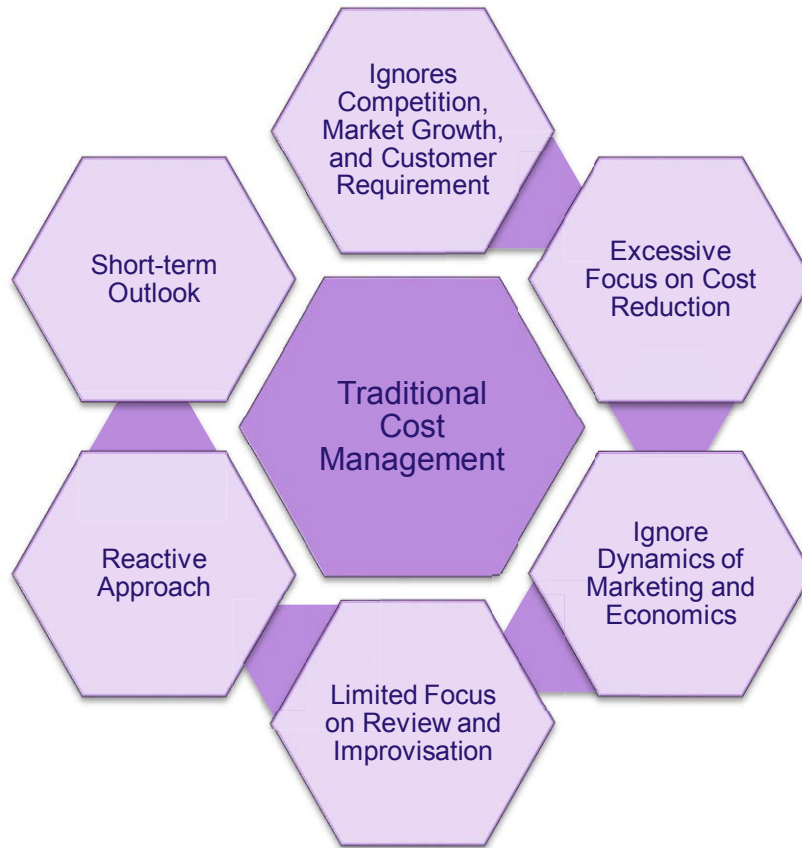
CHAPTER OVERVIEW



TRADITIONAL COST MANAGEMENT

Traditional cost management system involves allocation of costs and overheads to the production and focusses largely on cost control and cost reduction. The underlying assumption was that with reduced costs (direct) and overheads a firm could earn better profits. It involves comparing actual results with the standard expectations (typically budget or standard costs) and analysing the difference. This process is also known as variance analysis. A corrective action would be taken to ensure future outcomes are within the budgeted outcomes.

A traditional cost management system suffers from the following limitations:



- The focus is on cost control and reduction. However, a broad cost reduction programme doesn't work effectively in today's business environment. If a company targets to reduce the marketing spend by, say, 20% across the all product categories, it is likely that the sales of profitable products is also impacted.
- Traditional cost management system has internal focus and does not look at the external factors of competition, market growth, customer requirement etc.
- A broad-based cost reduction could lead to inferior quality of products & services which might drive away customers resulting in lower sales and profitability.
- The expectations of modern customer are quite different. An excessive focus on cost reduction could impact the quality of product and services and alienate the customers.
- Traditional cost accounting systems rely on accounting data which can be misleading at times. Financial statements can be a great reporting tool but might not be able to assist in strategic decision making. It does not consider dynamics of marketing and economics.
- There is a limited focus on review and improvisation of existing processes and activities.
- Traditional cost management is a reactive approach to cost management.
- It has a short-term outlook e.g. saving costs on an annual basis.

STRATEGIC COST MANAGEMENT

In the modern business environment, it is not sufficient to control costs and a business must focus to manage cost *strategically*. The businesses today operate in an environment with stiff competition, increasing consumer demands for quality products and technology revolution. The ultimate objective of a business is to earn better profits and create value for shareholders. This can be achieved by superior performance as compared to the competitors which results in distinctive competitive advantages.

A **strategy** is a set of actions taken by managers of a company to increase the company's performance.

Strategic cost management is the application of cost management techniques so that they improve the strategic position of a business as well as control costs. It also involves integrating cost information with the decision-making framework to support the overall organisational strategy. It is not limited to controlling costs but using cost information for management decision making. The cost management techniques should be such that they improve the strategic position of a business apart from focusing on controlling costs. The basic aim of Strategic Cost Management is to help the organisation to achieve the *sustainable competitive advantage* through *product differentiation* and *cost leadership*.

Strategic cost management lays a greater focus on continuous improvement to deliver superior quality product to the customers. Strategic cost management must be an integral part of the value chain. It needs to include all aspects of the production, purchase, design, manufacturing, delivery and service. It is important that strategic cost management is involved at early stages of a product development cycle to avoid heavy costs of failure.

Example

The following information is extracted from the financial statements of a company producing products A & B. If the company stops producing product B, the sale of A would fall down by 25%.

₹ lacs

Particulars	A	B
Revenue	60	35
Cost of Sales	35	25
Gross Profit	25	10
Overheads	5	12
Net Profit	20	-2

Analysis

If the information provided above is approached using a traditional cost management technique, the company might decide to stop production of B because it has a very overhead cost and also results in a loss of ₹ 2 lacs. It thus appears to be prudent to close down the production of B.

However, with additional information that sale of product A would fall down by 25% if B is not sold the decision might change. The company would lose ₹ 5 lacs (25% of 20 lacs) because of reduced sales of A. The net loss for the company if it decides to stop production of B is ₹ 3 lacs (2 lacs of savings from B and 5 lacs of loss of profits from A). Hence the decision to stop of production B is not prudent.

Case 1

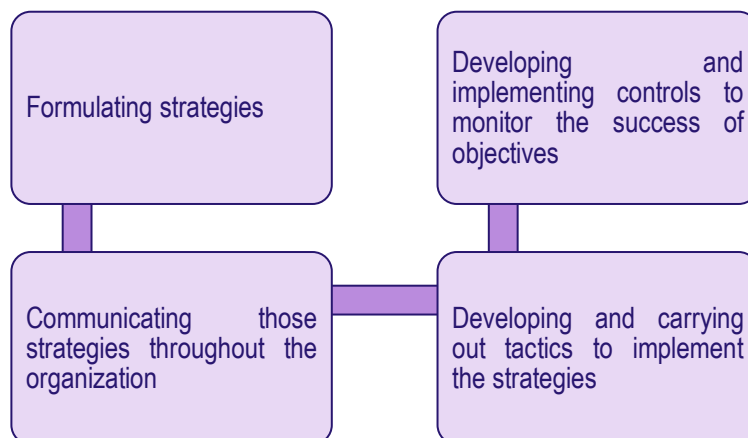
A manufacturing company does not carry out preventive maintenance of its machineries on a regular basis to save costs. Repairs of machinery is carried out as and when a machinery breaks down. This is a traditional approach to cost management where the focus is on cost reduction and cost saving. This is a short- term approach to manage costs.

When machinery breaks down, the company loses more in terms of loss time production and idle labour time. Lack of regular preventive maintenance and planned shutdown time also reduces the life of the machinery and has a longer- term impact. If the loss of production is significant, the company might lose market share to its competitors. Hence, it is important to look at cost management with a strategic focus.

Case 2

A telecom company closed down some of its customer service centres as a cost cutting measure. This led to overcrowding of customers at other centres and longer waiting time for the customers. The volume of work at other centres increased impacting the performance of employees. Both the customers and employees, two of the key stakeholders, were not happy with the company's decision. This type of business decision can impact the reputation and brand image of the company and impact the sales and profitability in the longer run.

Strategic cost management can be referred to as “the managerial use of cost information explicitly directed at one or more of the four stages of strategic management”:



Necessity of Strategic Cost Management

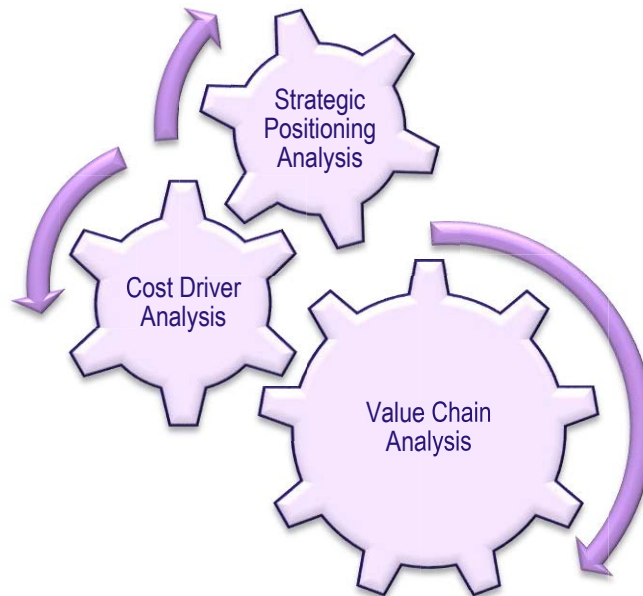
- It is cost analysis in a broader context where the strategic elements become more explicit and formal strengthening the strategic position of the company.
- Cost data is analysed and used strategically to develop alternate measures to gaining sustainable competitive advantages.
- SCM gives a clear understanding of the company's cost structure in search of sustainable competitive advantage.
- SCM is the managerial use of cost information explicitly directed to the four stages of strategic management – formulation, communication, implementation and control.
- SCM helps in overall recognition of cost relationships among the activities in the value chain and the process of managing these relationships to the company's competitive advantage.

Traditional vs. Strategic Cost Management

	Traditional Cost Management	Strategic Cost Management
Time Span	Short term concept	Long term concept
Focus	Internal	Both internal and external
Cost Driver Concept	Based on volume of the product.	Each value activity has a separate cost driver. So, not based on volume but on activities associated with the manufacturing of the product.
Objective	Score keeping, attention directing and problem solving.	Cost leadership or product differentiation.
Cost Reduction	Primary objective is cost reduction.	Primary objective is cost containment – cost reduction and value improvement at the same time.
Approach	Risk – averse.	Risk taking and ability to adapt itself with changing environment.

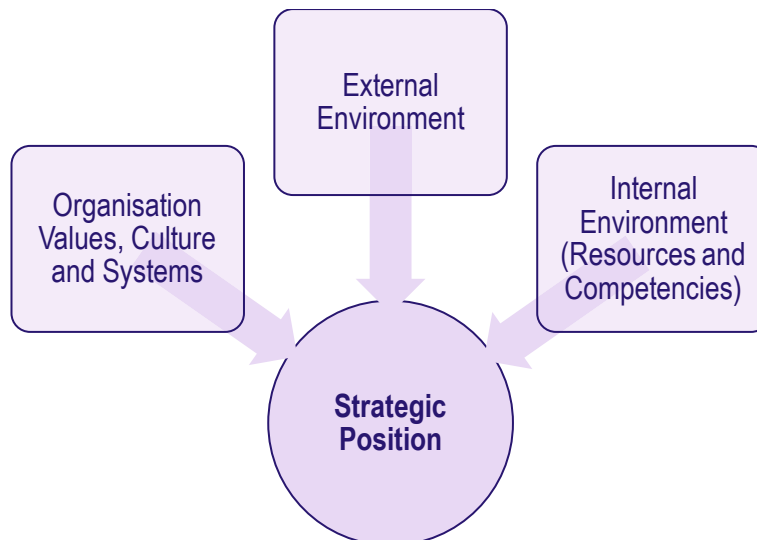
Components of Strategic Cost Management

Strategic Cost Management primary revolves around three business themes - Value Chain analysis, Cost driver analysis and Strategic positioning analysis.



Strategic Positioning Analysis

Strategic Positioning Analysis is a company's relative position within its industry matters for performance. Strategic positioning reflects choices a company makes about the kind of value it will create and how that value will be created differently than rivals. Strategic Positioning Analysis is concerned with impact of external and internal environment on the overall strategy of a company. It is important to take account of the future and to assess whether the current strategy is a suitable fit with the strategic position. The following factors affect the strategic position of a company –



External environment can be analysed using models like **PESTEL** (Political, Economic, Social, Technological, Environmental and Legal factors) and **Porter's 5 forces**.

Cost Driver Analysis

Cost is caused or driven by various factors which are interrelated. Cost is not a simple function of volume or output as considered by traditional cost accounting systems. Cost driver concept is explained in two broad ways in strategic cost management parlance - Structural cost drivers and Executional cost drivers.

Structural cost drivers are the organisational factors which affect the costs of a firm's product. These factors drive costs of an organisation in varied ways. The scale and scope of operation of a company will impact the costs. A larger scale of operations is likely to give an advantage of economies of scale. The usage of technology and complexity of operations also determine the costs of various activities within a firm. The *experience or learning curve* also impacts the costs being incurred by a firm. The product development process could be costlier earlier and cheaper in later stages of a lifecycle. A simple volume based cost allocation would not be appropriate in such cases.

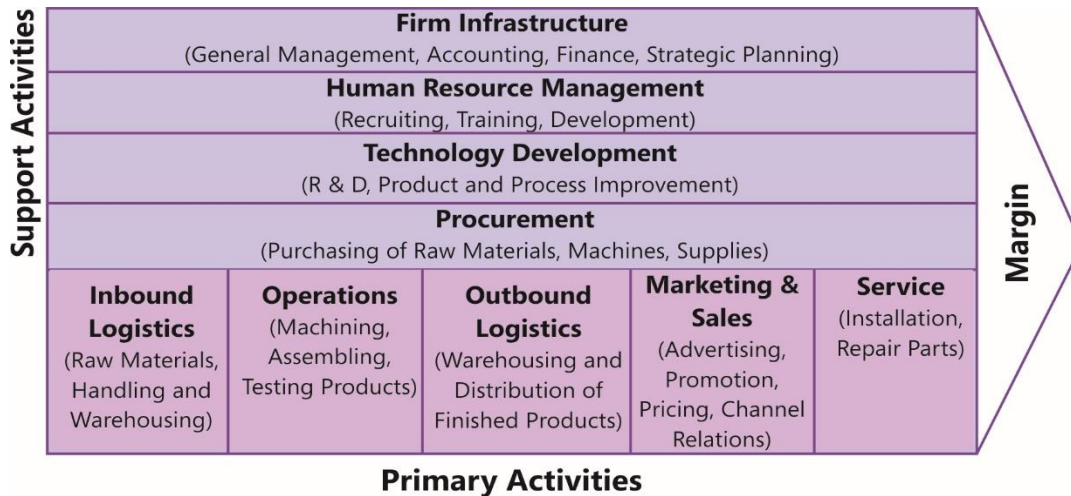
Executional cost drivers are based on firm's operational decision on how the various resources are employed to achieve the goals and objectives. These cost drivers are determined by management style and policy. The participation of workforce towards continuous improvement, importance of total quality management, efficiency of plant layout etc. are examples of executional cost drivers.

In case of a strategic analysis, volume is not the most appropriate way to explain costs. It is more relevant to explain costs based on strategic choices and executional skills. All cost drivers might not be important at all times. A company must focus on those cost drivers which is of strategic importance.

Value Chain Analysis

Value-chain analysis is a process by which a firm identifies & analyses various activities that add value to the final product. The idea is to identify those activities which do not add value to the final product/service and eliminate such non-value adding activities. The analysis of value chain helps a firm obtain cost leadership or improve product differentiation. Resources must be deployed in those activities that are capable of producing products valued by customers.

The idea of a value chain was first suggested by Michael Porter (1985) to depict how customer value accumulates along a chain of activities that lead to an end product or service.



Porter describes the value chain as “*internal processes or activities a company performs to design, produce, market, deliver and support its product.*” He further stated that “*a firm’s value chain and the way it performs individual activities are a reflection of its history, its strategy, its approach of implementing its strategy, and the underlying economics of the activities themselves.*”

The concepts, tools and techniques of value chain analysis apply to all those organisations which produce and sell a product or provide a service.

The various activities undertaken by a firm can be broadly classified into Primary activities and Secondary activities. Primary activities are those which are directly involved in transforming of inputs (Raw Material) into outputs (Finished Products) or in provision of service. Secondary activities (also known as support activities) support the primary activities. Though, secondary activities are not directly involved in creation of product, it doesn't mean that they are of less importance as compared to primary activities.

Primary Activities include:

- *Inbound Logistics*: These are activities concerned with receiving, storing, and distributing the inputs (raw materials) to the production process. The relationship with suppliers is a key component in this process.
- *Operations*: These activities involve transforming inputs into final product. Activities such as machining, packaging, testing and equipment maintenance form part of Operations.
- *Outbound Logistics*: These activities involve collecting, storing and distributing the products from the factory line to end consumers. This may include finished goods warehousing, delivery vehicle operation, order processing and scheduling.
- *Marketing and Sales*: Marketing and Sales provide the means by which the customers are made aware of the product. The activities include advertising, promotion, distribution channel selection, sales force management and pricing policy.

- *Service*: This includes activities related to after sales service like Installation, repair and parts replacement.

Support Activities include:

- *Procurement* involves purchasing of raw material, supplies and other consumables required as inputs for the primary activities.
- *Technological Development* includes technical knowledge, equipment, hardware, software and any other knowledge which is used in the transformation of inputs to outputs.
- *Human Resource Management* includes activities around selection, recruitment, placement, training, appraisal, rewards and promotion; management development; and labour/ employee relations.
- *Firm Infrastructure* consists of activities such as planning, finance, accounting, legal, government affairs and quality management.

A Value Chain gives managers a deeper understanding of what the organisation does and helps them identify key processes of the business. The various processes can be analysed to identify those activities which do not add value to consumers. Such non-value activity can be eliminated to add to the margins of the business as a whole.

Case Scenario

ABC Ltd. is engaged in business of manufacturing branded readymade garments. It has a single manufacturing facility at Ludhiana. Raw material is supplied by various suppliers.

Majority of its revenue comes from export to Euro Zone and US. To strengthen its position further in the Global Market, it is planning to enhance quality and provide assurance through long term warranty.

For the coming years company has set objective to reduce the quality costs in each of the primary activities in its value chain.

Required

STATE the primary activities as per Porter's Value Chain Analysis in the value chain of ABC Ltd with brief description.

Solution

Primary activities are the activities that are directly involved in transforming inputs into outputs and delivery and after-sales support to output. Following are the primary activities in the value chain of ABC Ltd.:-

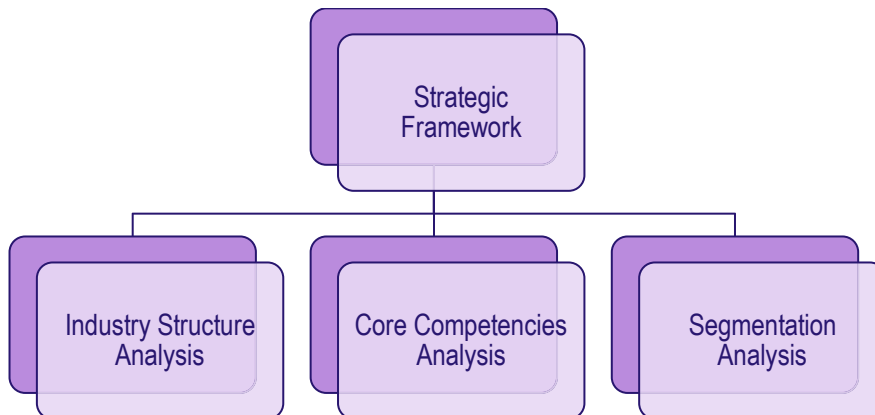
- Inbound Logistics**: These activities are related to the material handling and warehousing. It also covers transporting raw material (yarn or fabric) from the supplier to the place of processing inside the factory at Ludhiana.
- Operations**: These activities are directly responsible for the transformation of yarn or fabric into final readymade garments for the delivery to the consumers.

- (iii) **Outbound Logistics:** These activities are involved in movement of readymade garments to the point of sales. Order processing and distribution are major part of these activities.
- (iv) **Marketing and Sales:** These activities are performed for demand creation and customer solicitation. Communication, pricing and channel management are major part of these activities.
- (v) **Service:** These activities are performed after selling the goods to the consumers. i.e. replacing after a couple of sessions.



STRATEGIC FRAMEWORKS FOR VALUE CHAIN ANALYSIS

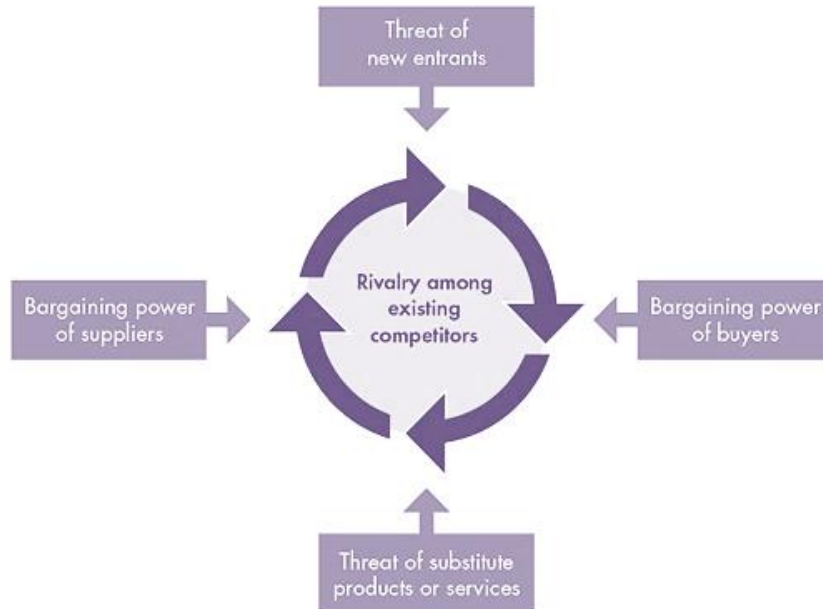
Value Chain analysis requires internal information (for internal value chain) and external information (for industry value chain). The Value Chain analysis requires strategic framework for organising varied information. The following three are generally accepted strategic framework for Value Chain analysis.



Industry Structure Analysis (Porter's 5 forces analysis)

An industry might not yield high profits just because the industry is large or growing. The five forces suggested by Porter's play an important role in determining profit potential of the firms in an industry. Michael Porter developed a five factors model as a way to organise information about an industry structure to evaluate its potential attractiveness.

Factors which influence profitability are:



- **Bargaining power of buyers:** The bargaining power of buyers generally determines the ability of buyer to push the price down. This happens when the buyers are concentrated or when the volume purchased by buyers is very high. In other words, when the bargaining power of buyers is high, they would be in a position to dictate terms to the firm. A buyer also has higher bargaining power if the cost of switching suppliers is very low. A higher bargaining power results in lower profitability. Large companies have a high bargaining power when they buy from small suppliers.
- **Bargaining power of suppliers:** The bargaining power of supplier is relatively higher when the input is important to the buying firm or when there are very few suppliers of the input. The suppliers could also dictate terms if the input supplied is not replaceable or when an alternate input is not available. Microsoft dominates the operating system business of computers and laptops and can dictate terms to its buyers as buyers do not have multiple options to choose from. The profitability of companies can shrink if the suppliers have a higher bargaining power.
- **Threat of substitute products or services:** When multiple and close substitutes are available in the market for a particular product, customers are likely to switch suppliers easily. A firm in such a case must resort to competitive pricing to retain its customers. When few substitutes exist for a product, consumers are willing to pay a potentially high price. If close substitutes for a product exist, then there is a limit to what price customers are willing to pay. The problem becomes severe if substitutes are available at much cheaper price (case of launch of Reliance Jio). A company should strive to build its brand and customer loyalty to thwart the threat of substitutes.

Substitutes could be from within the industry or from a different industry. The paper industry faces threats from e-book market. When more people switch to public transport as trains, the demand for vehicles comes down.

- **Threat of new entrants:** The threat of new entrants largely depends on the barrier to entry and perceived profitability in an industry. If an industry is profitable and the barriers to entry are low, new firms could enter the industry leading to excess supplies and reduced prices. Some examples of barriers to entry are intensive capital requirement, sophisticated technology, legal factors, limited access to raw material & labour etc.

Industries which require huge amount of capital or sophisticated technical knowhow might not have a high threat of new firms entering into the industry. Airline industry is a case where very few new firms enter the business because of the capital requirements. Another barrier to entry could be legislation which restricts newer firms to start the business, like in the case of defense industry. Certain industries (for example medicines) are largely driven by patents and new firms might find it difficult to enter the industry. An industry where threat of new entrants is low is more profitable than an industry where new entrants can easily enter the industry.

- **Intensity of competition/ rivalry amongst firms:** Some markets are more competitive than others. In highly competitive industries, firms resort to cut-throat competition to win more customers. The competitive rivalry is higher when an industry has high number of firms and is lower when there are few large players dominating the market. The intensity of competition is higher:
 - When firms are of more or less equal size.
 - Extra capacity exists in the industry
 - Difficulty in differentiation in the products.
 - High exit barriers - This is a case where the exit costs are high and hence firms must continue in the industry despite excess capacity at industry level.
 - Higher fixed costs - Firms would want to produce as much as possible to keep the unit costs low leading to surplus capacity.

Since these five forces are ever-changing, Porter's framework needs to be employed as a *dynamic analytical tool*. This is because competition is a dynamic process; equilibrium is never reached and industry structures are constantly being reformed. The five forces analysis helps a firm to better understand the industry value chain and its competitive environment.

Case Scenario

WDG is a family owned business. The family owns 80% of the shares. The remaining 20% is owned by six non- family shareholders. It manufactures Cardboard Boxes for customers which are mainly manufacturers of shoes, cloths, crackers etc. Now, the board is considering to join the Paper Tubes market as well. Paper Tubes, also known as Cardboard Tubes, are cylinder-shaped components that are made with Cardboard. Paper Tubes can be used for a wide range of functions. Paper Tubes are usually ordered in bulk by many industries that rely Paper Tubes

include food processing, shipping and the postal service, automotive manufacturing, material handling, textile, pulp and paper, packaging, and art etc. The Paper Tubes cost approximately 1% - 3% of the total cost of the customer's finished goods. The information about Paper Tubes is as follows:

- (i) The Paper Tubes are made in machines of different size. The lowest cost machine is of ₹ 1,89,000 including GST @ 5% and only one operator is required to run this machine. Two days training program is required to enable untrained person to run such a machine efficiently and effectively. A special paper is used in making Paper Tubes and this paper remains in short supply.
- (ii) Presently, five major manufacturers of Paper Tubes have a total market share of 75%, offer product ranges which are similar in size and quality. The market leader currently has 24% share and the four remaining competitors hold on average 12.75% share. The annual market growth is 3% per annum during recent years.
- (iii) A current report "Insight on Global Activities of Foreign Based MNCs" released the news that now MNC's are planning to expand their packaging operations in overseas market by installing automated machines to produce Paper Tubes of any size.
- (iv) Another company, HEG manufactures a small, however increasing, range of Plastic Tubes which are capable of housing small products such as foils and paper-based products. Currently, these tubes are on an average 15% more costly than the equivalent sized Paper Tubes.

Required

ASSESS whether WDG should join the Paper Tubes market as a performance improvement strategy?

Solution

To assess the feasibility of joining Paper Tubes market, Michael Porter's 'five forces model' can be used. It analyses the competitive environment of an industry. It is an important tool for understanding the competitive structure of a particular industry. This complete analysis includes five forces: buyer's bargaining power, supplier's bargaining power, the threat of substitute products, the threat of new entrants and the intra industry competition.

While applying this model to the above case, it can be observed that the low cost of the machine along with the fact that an untrained person will only need two day's training as to be able to operate a machine, will form comparatively low costs of entry to the market. Therefore, WDG may reasonably consider *high threat of new entrants*.

Customer's (buyer) power could be high since customers buy Paper Tubes in bulk along with the fact that there is insignificant difference between the products of alternative suppliers. Paper Tubes cost approximately 1% - 3% of the total cost of the customer's finished goods also indicates that *customer's power is high*.

The fact that the special paper from which the tubes are made remain in short supply, signals

high threat from suppliers. Hence, suppliers may raise their prices that would result in reduction of profit.

Five major players with 75% market share, offer product ranges which are similar in size and quality, besides, the market is a slow growing i.e. annual growth of 3% p.a., indicate *high rivalry among competitors.*

A little real threat from a substitute product exist since HEG manufactures a narrow range of Plastic Tubes. This threat might go up if the product range of HEG is expanded or the price of Plastic Tubes goes down sharply.

Major threat from potential new entrants can be seen, as foreign-based MNCs are planning to joining this market and it seems that these giant corporations might be able to gain economies of scale from automated machines and large production lines with manufacturing flexibility.

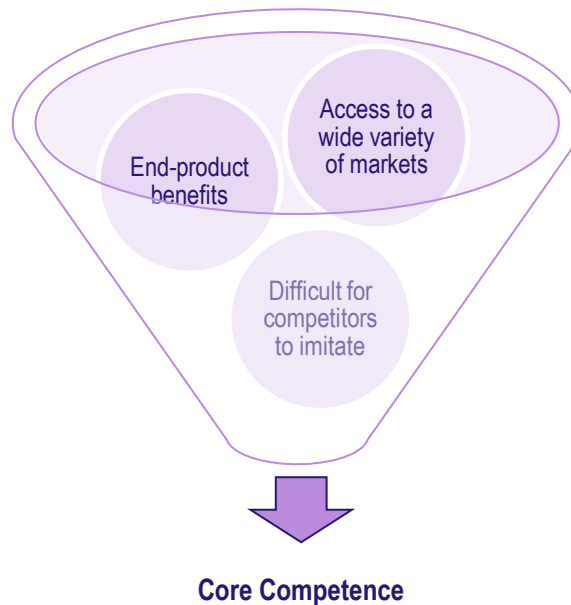
WDG might enter this market due to low capital investment but this would also lead to other potential entrants. The easy entry, threat of substitute, the existence of established competitors in the market, the possible entry of a MNCs, and competitors struggling due to slow growth market are putting the potential of WDG into the question to achieve any sort of competitive advantage.

Joining this market might be a good move, if WDG would be able manufacture Paper Tubes at lowest cost within the industry. To assess feasibility, WDG must take into consideration *all possible synergies* between its existing operations of Card Boxes and the proposed operations of Paper Tubes.

From the available information, joining the market for Paper Tubes does not seem to be attractive. Thus, WDG should go for other alternative performance improvement strategy.

Core Competencies Analysis

Core Competency is a distinctive or unique skill or technological knowhow that creates distinctive customer value. The core competency of Google is its capability to deliver excellent search results which could not be imitated by its competitors. The core competencies are a function of the collective skillset of people, organisation structure resources & technological knowhow. A core competency is the primary source of an organisation's competitive advantage. The competitive advantage could result from *cost leadership* or *product differentiation*. There are three tests useful for identifying a core competence.



The loss of core competencies could be disaster for firms. Nokia was a leader in the feature phones segment till smart phones were introduced. The changing dynamics of industry meant that Nokia lost the top position in mobile phone industry and led to sale of the business to Microsoft. Bajaj Auto, who had core competency in the scooter segment, lost traction when motorbikes were introduced. It is thus important that the firms continuously evolve their core competencies and remain relevant in the ever-changing business environment.

Core competencies stem from two sources:

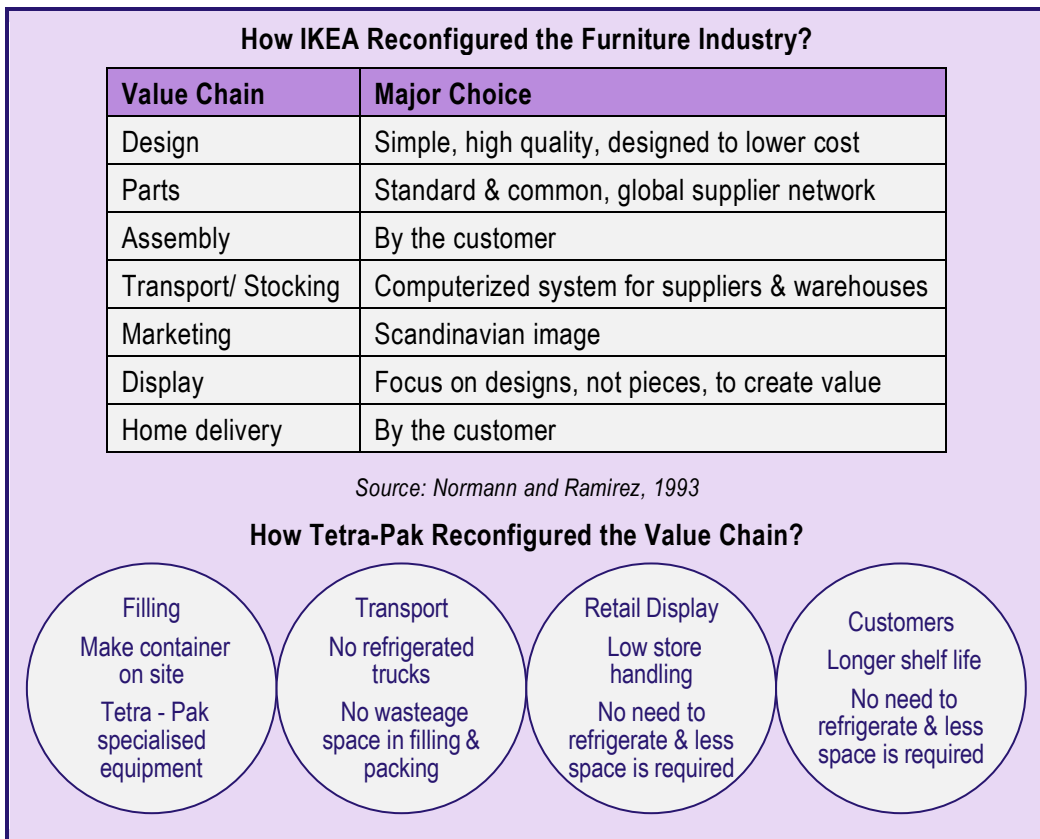
Resources: Resources are factors that enable a company to create value for customers. They can be tangible (land, buildings, inventory, machinery, money etc.) or intangible (employee's skills, brand, patent, technology etc.). The more difficult a resource is to imitate, the more valuable is the resource for the company. The algorithms used by Google to deliver search results are not easily imitated by competition. Similarly, the secret formula of concentrates used by soft drinks manufacturers like Coca Cola are hard to copy.

Capabilities: Capabilities refer to the company's ability to co-ordinate resources and put them to productive use. Availability of resources by themselves does not guarantee core competency and success. Capabilities stem from organisational structure, processes and control systems.

Applying the value chain approach to core competencies for competitive advantage includes the following steps:

- **Validate core competencies in current businesses:** Core competencies must lead to a competitive advantage to the business and the existence of core competencies be validated continuously.

- **Leverage competencies to the value chains of other existing businesses:** A core competency in one segment of business can be used in another existing/new business. An excellent distribution network in one business can be used to launch another product. Example - If a bank has wide network of branches in its banking business, the same network can be used to launch and sell insurance products.
- **Use core competencies to reconfigure the value chains of existing businesses:** While firms may manage their existing value chains better than their competitors, sophisticated firms work harder on using their core competencies to reconfigure the value chain to improve payoffs. Otherwise, competitors may exploit opportunities.



- **Use core competencies to create new value chains:** With strong core competencies in its existing businesses, an organisation can seek new customers by developing new value chains.

For example, FedEx transferred its expertise in the delivery of small packages to contract new business with L.L. Bean for overnight distribution. Disney has exported its people-moving skills to urban mass transit for Oakland, California.

Segmentation Analysis

A single industry might be a collection of different market segments. Motor vehicle industry, for example, can be seen as a composite of tyre, glass, battery, metals etc. Not all firms in an industry participate in all segments. The structural characteristics of different industry segments need to be examined.

This analysis will reveal the competitive advantages or disadvantages of different segments. A firm may use this information to decide to exit the segment, to enter a segment, reconfigure one or more segments, or embark on cost reduction/ differentiation programs.



- **Identify segmentation variables and categories:** An industry might be divided into multiple segments depending upon the nature and complexity of the industry. The segmentation could be based on the nature of products or geographies or customers.
- **Construct a segmentation matrix:** After the segments are identified, a segmentation matrix (generally two way) can be created. ITC could create a matrix based on the nature of products (Cigarettes, Hotels, Textile, Paper etc.) and geographies (North, East, West and South). Another way could be to create a matrix using products and distribution channel (wholesale, retail, direct).
- **Analyse segment attractiveness:** The segmentation matrix could be used to evaluate profitability and performance of each of the segment. The interrelationship between various segments (say distribution channels, similar products) must also be considered while analysing segmental attractiveness.
- **Identify key success factors for each segment:** Each segment identified must be assessed with a relevant measure of performance. It could be quality of product, service, timeliness of delivery etc. A single performance measure across all segments is not advisable. A measure which suits the service segment will not suit the manufacturing segment.
- **Analyse attractiveness of broad versus narrow segment scope:** The company must identify whether it wants to be in a broad segment or a narrow one. Narrower segments could be risky for business as a single segment could be vulnerable to the competition. Multiple segments help a company to spread costs across the various segments. The company might also be in a position to use the competency of one segment in other segments. Some firms might abandon certain segments because of lack of profitability. The competitive advantage of each segment may be identified in terms of low cost and/or differentiation.



SUPERIOR PERFORMANCE & COMPETITIVE ADVANTAGE

The ultimate objective of a for-profit company is to achieve superior performance in comparison to their competitors. A company which attains superior performance gets a definitive competitive advantage. The company's profitability is improved with superior performance which leads to the maximisation of shareholder's wealth.

In order to survive and prosper in an industry, firms must meet two criteria:

- They must supply what customers want to buy and
- They must survive competition.

A firm's overall competitive advantage derives from the difference between the value it offers to customers and its cost of creating that customer value.

In order to attain superior performance and attain competitive advantage, a firm must have distinctive competencies. Distinctive competencies can take any of the following two forms:

- An offering or ***differentiation advantage***. If customers perceive a product or service as superior, they become more willing to pay a premium price relative to the price they will have to pay for competing offerings. Example: Customers of Apple pay a higher price for its products.
- Relative ***low-cost advantage***, under which customers gain when a company's total costs undercut those of its average competitor. Example: A company which can provide similar products at much lower costs.

Differentiation Advantage (Product Differentiation)

It occurs when customers perceive that a business unit's product offering is of higher quality, involves fewer risks and/or outperforms products offered by competitors. In other words, customers perceive the product or service offered by a business to be superior. For example, differentiation may include a firm's ability to deliver goods and services in a timely manner, to produce better quality, to offer the customer a wider range of goods and services, and other factors that provide unique customer value.

A differentiation advantage can be achieved by adopting the following techniques:

- Superior Quality: The customers are offered a better-quality product in the similar price range. The quality of product or service offering is such that the company becomes a preferred choice of its customers.
- Superior Innovation: The company continuously offers innovative products ahead of its competition.
- Superior Customer Responsiveness: The company produces products or provides services which are aligned with customer's expectation. The company also focusses on overall customer service and works towards parameters like reducing waiting time, on time delivery etc.

Once a company has successfully differentiated its offering, management may exploit the advantage in one of two ways viz., either; increase price until it just offsets the cost of improvement in customer benefits, thus maintaining current market share; or price below the "full premium" level in order to build market share. Companies like Apple charge premium prices from its customers because customers perceive Apple's product to be different from others.

*Value chain analysis can identify the points at which **Differentiation Advantage** can be achieved by:*

- Producing products which are superior to competitors by virtue of design, knowhow, performance, etc.
- Offering superior after-sales service by outstanding distribution.
- Expanding the product range
- Superior packaging of the product.
- Making brand strength.

Low-Cost Advantage (Cost Leadership)

A firm enjoys a relative cost advantage if its total costs are lower than those of its competitors. This relative cost advantage enables a business to do one of the following:

- Charge a lower price than its competitors for its product or services in order to gain market share and still maintain current profitability; or
- Match with the price of competing products or services and increase its profitability.

A company must choose a strategy in which it can lower its cost and thereby gain a competitive advantage. Many sources of cost advantage exist - access to low-cost raw materials; innovative process technology; low-cost access to distribution channels or customers; and superior operating management. A company might also gain a relative cost advantage by exploiting economies of scale in some markets.

Example - A refinery which has superior technology can process low grade crude to produce oil. Since low grade crude is cheaper than what the competitors pay for high grade crude, the company might be in a position to charge lower price & gain additional market share or charge higher price and earn better profits.

A disadvantage of this strategy is that competitors might find way to lower their costs as well. Hence, a company which pursues a cost leadership strategy must continuously improve its cost structure. Another risk associated with cost leadership strategy is that managers might try to lower costs by compromising the quality of products.

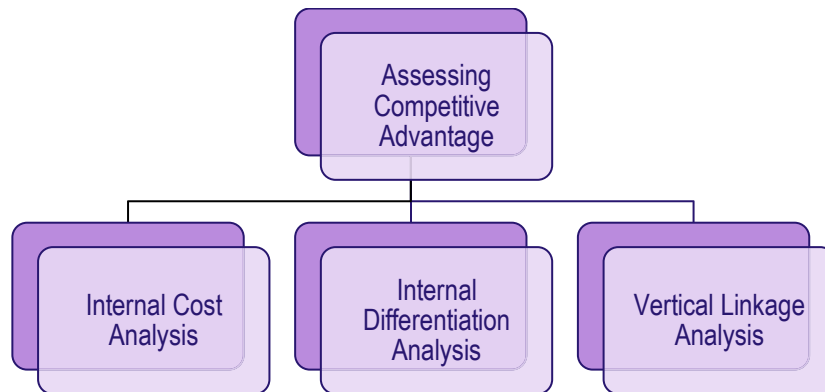
*Value chain analysis is central to identifying where cost savings can be made at various stages in the value chain. **Value chain analysis can identify the points at which **Low Cost Advantage** can be achieved:***

- Reduce costs by copying rather than creating designs, using cheaper materials and other cheaper resources, reducing labour costs and increasing labour productivity.
- Attaining economies of scale by high-volume sales.
- Use high-volume purchasing to get discounts for bulk purchase.
- Locating in areas where cost advantage exists or government support is possible.
- Gaining learning and experience curve benefits.

The company must look at its **value chain**, which consists of all of its functions – production, marketing, R&D, customer service, information systems, materials management, human resources – to determine each one's role in lowering the cost structure and/ or increasing customers' perceived utility through differentiation of its product or service.

THE VALUE CHAIN APPROACH FOR ASSESSING COMPETITIVE ADVANTAGE

The value chain model can be used by business to assess the competitive advantage. Companies must not only focus on the end product/ service but also on the *process/ activities* involved in creation of these products/ services. The value chain approach can be used to better understand the competitive advantage in the following areas:



Internal Cost Analysis

Organisations can use the value chain analysis to understand the cost of processes and activities and identify the source of profitability. The following steps are generally used to carry out an internal cost analysis.

- **Identify the firm's value-creating processes:** This is the first step in which a firm identifies its value-creating processes. Traditionally, businesses organise themselves into various cost, revenue and profit centres. The businesses are also organised on a functional structure with different layers of hierarchy. These types of classification or organisation does not help firm understand the contribution of each activity.

The key is to classify activities to understand their true contribution to the firm's competitive advantage. Example - firms might have distinctive advantage in their procurement process or inbound logistics.

- **Determine the portion of the total cost of the product or service attributable to each value creating process:** The next step is to trace or assign costs and assets to each value-creating process identified. A company might use estimates to assign costs to the value creating activities. The costs of support activities must also be allocated to get a full picture of

costs. Example: A new ERP system might reduce the inbound logistics costs with proper inventory management but would increase the cost on IT front. Unless such costs are identified and allocated, the analysis would not give a clear picture. Many of the processes identified may be instrumental for achieving competitive advantage.

- **Identify the cost drivers for each process:** The company identifies the factors which drive costs. A change in cost driver leads to a change in the overall cost. The next step of internal cost analysis is to identify the factor or cost determinants for each value-creating process. Once the factors driving costs are identified, business can assign priority in its cost management activities.

Management accounting systems may not reveal the causes or factors for the significant individual costs. The use of a single output or volume measures to assign costs can also be misleading at times. *Multiple cost drivers usually provide more useful information and analysis. The companies are using activity based costing to gain a better understanding of the resources consumed and costs incurred for a certain activity.*

- **Identify the links between processes:** The value chain analysis considers individual value activities as separate and discrete. However, the individual activities are not independent and are not expected to function in silos. Most activities within a value chain are interdependent and the linkages between the various activities might impact the total cost. The cost improvement programs in one value chain may lower or increase cost in other processes. An increase in automation might reduce the manpower cost but would also increase the technology cost.
- **Evaluate the opportunities for achieving relative cost advantage:** Traditionally firms and businesses have adopted across the board cost reduction. Such an approach (E.g. reduce costs under all heads by 15%) does not solve the actual problem as the costs are not reduced strategically. Such an approach might lead to forceful reduction of costs in certain areas like marketing which might impact the sales.

Certain activities might provide a larger opportunity for reducing costs while other activities might require that costs are incurred at current level or may be even at higher levels. *Using the value chain approach, a company goes beyond simple across-the-board cuts and attempts to lower cost and improve efficiency within each value-creating process.*

Reducing process input costs often means negotiating lower wages or moving production to countries with cheaper labour costs. Suppliers might be willing to drop their prices if the company negotiates long-term contracts. Companies also use buyer-seller partnerships to gain advantages in cost, quality, time, flexibility, delivery and technology.

Internal Differentiation Analysis

Companies can also use value chain analysis to create and offer superior differentiation to the customers. The focus is on improving the value perceived by customers on the companies' products and service offering. The firms must identify and analyse the value creating process and carry out a differentiation analysis.

- **Identify the customer's value creating processes:** The company must identify various activities in its value chain which are undertaken to deliver products/ services to its customers. Differentiation comes from the way various activities are performed and the way in which value chain is structured.
- **Evaluate differentiation strategies for enhancing customer value:** The company seeks to evaluate various strategies which could enhance the customer value. The strategies which a company can implement to enhance the customer value are:
 - Superior features in product - e.g. Premium cars, Phones etc.
 - Using effective marketing & distribution channels - e.g. on time delivery.
 - Excellent Customer Service - e.g. timeliness of repairs at effective cost, cleanliness at hotels etc.
 - Having a superior brand image - e.g. Apple, Google, Tata
 - Offering better quality product at competitive prices.
- **Determine the best sustainable differentiation strategies:** The activities which could enhance differentiation must be identified. A company must identify those strategies which could create sustainable product/ service differentiation. The selection of strategy must be according to the availability of resources.

Vertical Linkage Analysis

A company generates competitive advantage not only through linkages of internal processes within a firm but also through linkages between a firm's value chain and that of a suppliers or users. A vertical linkage analysis includes all upstream and downstream activities throughout the industry. The analysis encompasses activities beginning at source of raw material and ending at the final delivery of products to the customers. A company must have an understanding of not only its internal value chain but also of the industry value chain.

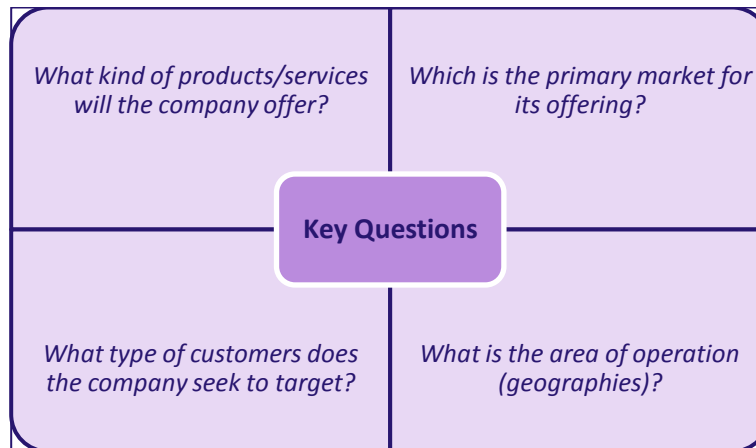
A company might not carry out all activities in the entire value chain of an industry. Hence, it might not be in a position to obtain information relating to costs and revenues for each process being carried out in the industry. However, such information is necessary for a firm to carry out a vertical linkage analysis. A company must identify the cost drivers for each of the process in the value chain of the industry as done in the case of the internal value chain analysis. A company must identify and evaluate the opportunities for sustainable competitive advantages after carrying out a industry value chain analysis.

Example - A company manufactures cars using various components like chassis, steering wheel, tyres, axles etc. The company does not manufacturer all the components in-house and are purchased from third party suppliers. The company focusses on assembly line which is its core competency. However, certain parts, which are critical to the car are manufactured in-house. This is a strategic choice to gain a competitive advantage.

In another case, a company could identify that there is virtually no competition in a particular process of the value chain. In such a case, it is less likely that the company might get a competitive price for the components it purchases. If there is only a single battery manufacturer, the car company might end up paying higher price. Such a situation could lead to a competitive disadvantage. A company might also carry out negotiations with its suppliers after an analysis of industry value chain. This generally happens when the company observes that certain section of value chain is charging excessive margin.

VISION, MISSION AND OBJECTIVES & SCM

A company's *mission statement* is a statement of the company's reason to be. It seeks to answer the question - "Why does the company exist?". It is a statement of organisation purpose and helps in addressing the following questions –



It might also include a statement of organisation value and major goals. A company's mission statement must be *customer focused* and not product focused.

A company's *vision* is what the company would like to achieve. A vision statement must be challenging and generally states an ambitious future. A good vision statement must motivate employees and managers to work towards the common organisation goals.

A company's *objective or goal* is a precise and measurable future state that the company wants to achieve. The purpose of objective or goal statement is to specify what needs to be done in order to attain the company's mission or vision. Goals must be specific and measurable as well as challenging and realistic.

The fundamental purpose of strategic planning and management is to align the vision and mission statements. A company's strategy is directed towards achieving a sustained competitive advantage. As discussed earlier, a competitive advantage is achieved by product differentiation and cost leadership. Strategic cost management is hence closely linked to the vision, mission and objectives of the company.

Management accounting draws on simple models of microeconomics and assumes that cost is primarily a function of only one cost driver, namely output/ volume. SCM, on the other hand, builds upon richer models of economics of industrial organisation and acknowledges that cost is driven by multiple factors that are interrelated.

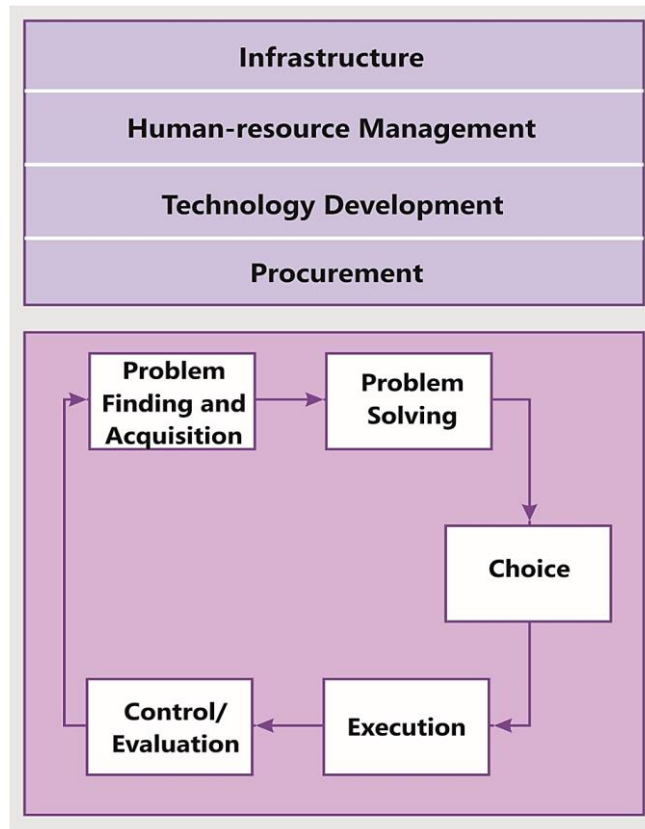
In the SCM frame work, effective cost management involves a broad focus which Porter calls the value chain. It is a strategic tool used to analyse internal firm activities. Its goal is to recognize, which activities are the most valuable (i.e. are the source of cost or differentiation advantage) to the firm and which ones could be improved to provide competitive advantage. Cost leadership can be achieved through techniques like target costing. Product differentiation is directly proportional to market movements and changing business requirements.

Strategic cost management is not a fine science but requires careful analysis of how strategic management concepts provide positive or adverse reactions to each element of value chain, positioning decisions and cost drivers. The art in doing this is working out strategies which have the most preferential cost benefits. There is overlap between these three different types of strategic cost management analysis techniques which can all relate back to executional, structural and organizational costs. Each type of analysis is aimed at establishing where cost benefits can be achieved through strategic choices managers make within the organisation.

VALUE SHOP MODEL OR SERVICE VALUE CHAIN

The concept of value shop came in to lime light holding the hand of Mr. James. D. Thompson in the year of 1967. However, it took more than thirty years to name the concept as 'Value shop'. In 1998 Mr. Charles B. Stabell and Mr. Oystein D. Fjeldstad in their research work properly defined the concept of 'Value Shop'. This concept aims to serve companies from *service sector*. In value shop principle, no value addition takes place. It only deals with the problem, figure-out the main area requires its service and finally comes with the solution. This approach is designed to *solve customer problems rather than creating value by producing output from an input of raw materials*. Value shops mobilizes resources (say: people, knowledge or money) to solve specific problems such as curing an illness or delivering a solution to a business problem. The 'problem' could also be how to exploit an opportunity. The shop process is iterative, involving repeatedly performing a generic set of activities until a solution is reached. This model applies best to telecommunication companies, but also to insurance companies and banks, whose business essentially is mediating between customers with different financial needs. **The model has the same support activities as Porter's Value Chain but the primary activities are described differently.** In the value shop they are:

- Problem finding and acquisition.
- Problem solving.
- Choosing among solutions.
- Execution and control/evaluation.



The management in a value shop focuses on areas like problem and opportunity assessment, resource mobilization, project management, solutions delivery, outcome measurement, and learning.

THE ROLE OF THE MANAGEMENT ACCOUNTANT

The management accountant is traditionally considered the resident expert on cost analysis; cost estimation; cost behaviour; standard costing; profitability analysis by product, customer or distribution channel; profit variance analysis; and financial analysis. Today, management accountants must also bring skills in activity-based costing, benchmarking, re-engineering, target costing, life-cycle costing, economic value analysis, total quality management and value chain analysis. Value chain analysis is a team effort. Management accountants need to collaborate with engineering, production, marketing, distribution and service professionals to focus on the strengths, weaknesses, opportunities and threats identified in the value chain analysis results. By championing the use of value chain analysis, the management accountant enhances the firm's value and demonstrates the value of the finance staff to the firm's growth and survival.

 **SUMMARY**

- The basic aim of Strategic Cost Management is to help the organisation to achieve the cost leadership to get the sustainable competitive advantage. A well-conceived cost reduction strategy enables the managers to capture maximum value in the form of direct savings. It is an effective way of reducing cost, increasing revenue and facilitating survival in the competitive world.
- Strategic cost management should be inherent to each stage of a product's life cycle, i.e. during the development, manufacturing, distribution and during the service lifetime of a product.
- Strategic cost management can be referred to as "the managerial use of cost information explicitly directed at one or more of the four stages of strategic management" viz Formulating strategies, communicating those strategies throughout the organization, Implementation the strategies, and Implementing controls to monitor the success of objectives.
- Composition of Strategic Cost Management – Cost Driver Analysis, Strategic Positioning Analysis and Value Chain Analysis.
- The Strategic Positioning of an organization includes the devising of the desired future position of the organization on the basis of present and foreseeable developments, and the making of plans to realize that positioning.
- Value Chain Analysis is a strategic tool used to analyse internal firm activities. Its goal is to recognize, which activities are the most valuable (i.e. are the source of cost or differentiation advantage) to the firm and which ones could be improved to provide competitive advantage. Cost leadership can be achieved through techniques like target costing. Product differentiation is directly proportional to market movements and changing business requirements.
- Benefits of Strategic Cost Management – Strategic elements become more explicit, cost data is used to develop alternate measures to gaining sustainable competitive advantages, clear understanding of the company's cost structure, managerial use of cost information explicitly directed to the four stages of strategic management – formulation, communication, implementation and control, overall recognition of cost relationships among the activities in the value chain.
- Porter describes the value chain as "internal processes or activities a company performs to design, produce, market, deliver and support its product." He further stated that "a firm's value chain and the way it performs individual activities are a reflection of its history, its strategy, its approach of implementing its strategy, and the underlying economics of the activities themselves."
- Classification of Business Activities for Value Chain Analysis –

Primary Activities: Primary activities are directly involved in transforming inputs into outputs and delivery and after-sales support to output. They include Inbound Logistics, Operations, Outbound Logistics, Marketing & Sales and Post-Purchase Service.

Support Activities: Support Activities are the activities which support primary activities. They are handled by the organisation's staff functions and include Procurement, Technology Development, Human Resource Management, Firm Infrastructure.

- **Differentiation Advantage**– It occurs when customers perceive that a business unit's product offering (defined to include all attributes relevant to the buying decision) is of higher quality, involves fewer risks and/or outperforms competing product offerings.
- **Low-Cost Advantage**– A firm enjoys a relative cost advantage if its total costs are lower than the market average. This relative cost advantage enables a business to do one of the two things; price its product or services lower than its competitors in order to gain market share and still maintain current profitability; or match with the price of competing products or services and increase its profitability.
- **The Value Chain Approach for Assessing Competitive Advantage**–
 - Internal Cost Analysis**– to determine the sources of profitability and the relative cost positions of internal value-creating processes;
 - Internal Differentiation Analysis**– to understand the sources of differentiation (including the cost) within internal value-creating processes; and
 - Vertical Linkage Analysis**– to understand the relationships and associated costs among external suppliers and customers in order to maximize the value delivered to customers and to minimize cost.
- **Strategic Frameworks for Value Chain Analysis**– Value chain analysis requires a strategic framework or focus for organizing internal and external information, for analyzing information, and for summarizing findings and recommendations. Three useful strategic frameworks for value chain analysis are,
 - Industry Structure Analysis, Core Competencies, and Segmentation Analysis.**
- **Porter's Five Forces Model**– Under this model, the profitability of an industry or market measured by the long-term return on investment of the average firm depends largely on five factors that influence profitability. These are:
 - Bargaining power of buyers; Bargaining power of suppliers; Threat of substitute products or services; Threat of new entrants; and Intensity of competition/ Degree of rivalry.**
- **Value Shop Model**– This approach is designed to solve customer problems rather than creating value by producing output from an input of raw materials. Value shops mobilizes resources (say: people, knowledge or money) to solve specific problems such as curing an illness or delivering a solution to a business problem.

The model has the same support activities as Porter's Value Chain but the primary activities are described differently as Problem finding and acquisition, Problem solving, Choosing among solutions, Execution and control/evaluation.

The management in a value shop focuses on areas like problem and opportunity assessment, resource mobilization, project management, solutions delivery, outcome measurement, and learning.

TEST YOUR KNOWLEDGE

Competitive Advantage

1. Wireless is a manufacturer of mobile phones. The company operates in a market that is dynamic, extremely competitive and consumer centric. The market is broadly fragmented into those customers who are price conscious looking only for basic features and those who are technology savvy wanting to try out the latest offering. Wireless manufactures phones that cater to both these segments.

Mobile A has the very basic features that a customer requires from a phone. It is marketed to attract the price conscious customers. There are many other manufacturers who have similar product offering for this market. Mobile Z offers the latest technology features and an attractive design. Wireless has invested substantial amount in research and development that has resulted in Mobile Z having many unique features. It is marketed to attract customers willing to try out newer products. The research has also yielded results whereby a large section of the design of Mobile A and Z can be standardized to have a similar components and engineering. This would enable Wireless to enter into agreements with its suppliers to provide components Just in Time based on the production schedule. With this change, the quality of Mobile A is expected to improve, thereby improving its sales offtake manifold.

Online shopping has given customers complete access to the prices of phones offered by different manufacturers. This channel of shopping contributes to almost 70% of the sales. Huge discounts by its rivals has forced Wireless to reduce the prices of Mobile A as well. This has stretched its profit margins. Various cost reduction measures have been initiated to maintain profitability. Mobile Z on the other hand is currently doing well since it is targeted at a more niche segment of customers. Wireless is able to charge premium price for Mobile Z. The latest news in the industry of personal devices like mobiles, laptops etc. is the use of Artificial Intelligence and Augmented Reality to enhance user experience. The technical staff at Wireless feel that this could be the next new frontier that could really change the way we use our devices, most of which could even go redundant.

Required

- (i) IDENTIFY the strategy that Wireless is using for Mobile A and Mobile Z.
- (ii) DISCUSS the risks involved in each of these strategies.
- (iii) ADVISE Wireless to sustain its current strategy for Mobile A?

 **ANSWERS/ SOLUTIONS**

1. (i) Wireless is following the “low cost strategy” for Mobile A and “differentiation strategy” for Mobile Z. Mobile A is being offered at discounted rates to meet the prices of its competitors. This is being done in order to gain market share from its competitors. To maintain its profitability, Wireless has to find means to keep its manufacturing, distributing and other costs low.

Mobile Z is being perceived by customers as a unique product, with features different from its competitors. This is “differentiation strategy”. Differentiation can be achieved from superior product quality, innovation and customer responsiveness.

- (ii) The risks involved in a “low cost strategy” for Mobile A is that any price reduction by Wireless will be followed by an equivalent price reduction by its competitors. This price war will ultimately eliminate players who are unprofitable. This strategy will put margins under pressure. The company has to find ways to its costs low on a sustained basis. The “low cost advantage” will be lost once its competitors find a way to lower their costs as well. The other risk would be to that the quality of the product could be impacted negatively due to lowering of costs.

The risks in differentiation strategy is that it will work only when customers are not price sensitive. The mobile market that Wireless operates is a competitive market. As long as certain customers are will to pay extra for additional features, Mobile Z will have a competitive advantage. If these customers also become price sensitive, they fail to see the value for paying extra for the additional features, the sales of Mobile Z will start falling. The other risk in this strategy would be in the ability of competitors to replicate the features of Mobile Z. Therefore, Wireless should protect its intellectual property rights in order to prevent its competitors from replicating the design and features of Mobile Z. It only when these risks are contained, that Wireless would be able to maintain its premium price for Mobile Z for its unique features.

An external risk factor for Wireless would also be from the developments in the fields of Artificial Intelligence and Augmented Reality. Wireless has to constantly monitor and assess how these technological developments can impact its business. It must be flexible to adapt to changes as they take place, in order not to become redundant in business.

- (iii) “Low cost advantage” can be maintained by copying designs rather than creating them, attaining economies of scale by high-volume sales, getting discounts on bulk purchases and gaining learning and experience curve benefits.

Learnings and experience from research for Mobile Z can be leveraged for Mobile A. Standardization of design for Mobile Z and A would improve the quality of the product since the design is based on a product that has premium range of customers. Since

these features can improve the sales of Mobile A, costs would benefit from economies of scale due to larger production volumes.

Bulk purchase of components for Mobile A and Z gives Wireless the advantage of negotiating for discounts on purchases. It could also negotiate for favorable delivery terms, like just in time purchasing agreements. This would reduce the inventory holding costs for Wireless.

All this contributes towards lowering the costs of production of Mobile A. This will help Wireless sustain its low-cost advantage.



MODERN BUSINESS ENVIRONMENT



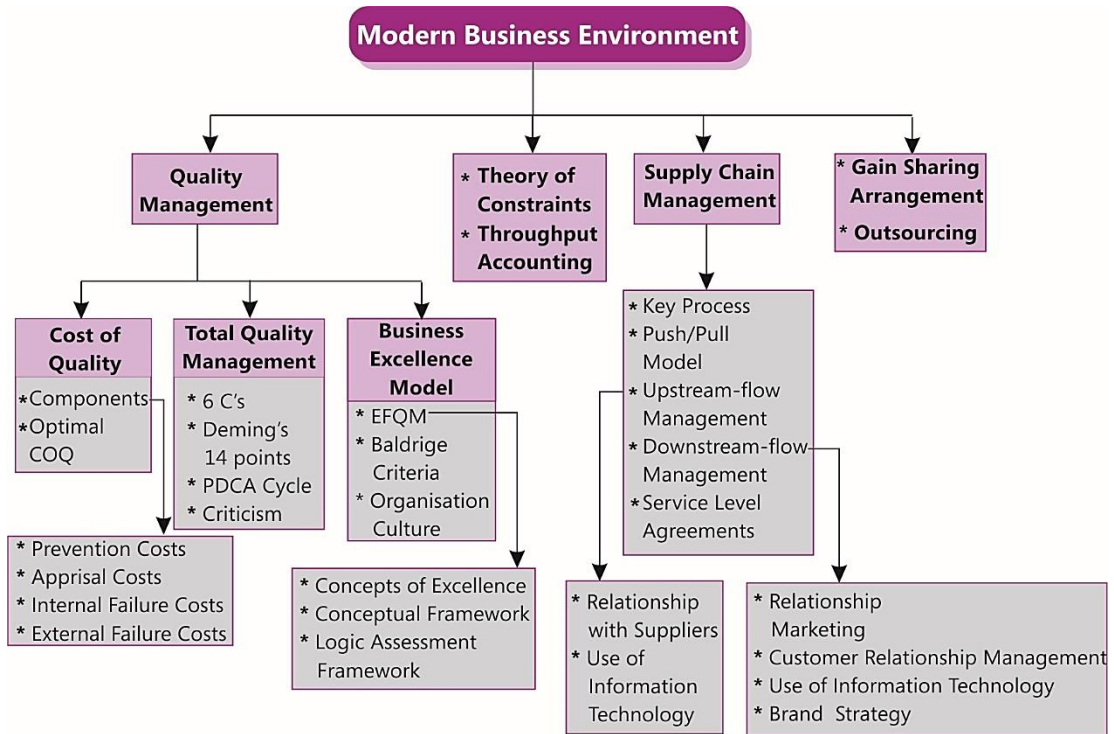
LEARNING OUTCOMES

After studying this chapter, you will be able to:

- ❑ **Explain**, Modern Business Environment
- ❑ **Evaluate** Total Quality Management (TQM), Cost of Quality, Business Excellence Model & Supply Chain Management
- ❑ **Discuss and Apply** the Theory of Constraints



CHAPTER OVERVIEW



MODERN BUSINESS ENVIRONMENT

During the past two decades, the business environment in many sectors has been characterized by rapid changes. The environment is ever changing and dynamic in nature. The modern business environment has changed drastically and shaped entirely, in a very different manner. Now, it has become a challenge for business managers to understand their business environment and formulate business plans and policies accordingly. Business technology has advanced business functions and operations to new levels. The role of accounting is one of the most reliable functions in business.

The main revolution has been the transition from a seller's market to a **buyer's market**. Earlier the supplier or service provider dictated the dimensions of a transaction:

Price - usually determined by a "cost plus" approach.

Response time - determined by the supplier.

Quality - determined by the service/ product provider.

Performance - dictated to the customer.

From a Sellers' Market to Buyers' Market

Today's business environment is that of a buyer's market. This trend is the result of international transitions and macroeconomic, technological, political, and social changes. This environment is characterized by:

- Globalization of the world economy.
- Fierce competition among organizations within and across countries.
- Global excess capacities in production, services, and in some areas of development.
- Using new managerial methods.
- Availability and accessibility of data and knowledge.
- Timely availability of materials and services.
- Ease of global travel and transportation.

The challenge for businesses today is to *satisfy their customers through the exceptional performance of their processes*. Therefore, in this chapter, we first address the Cost of Quality, Total Quality Management, and then focus on Supply Chain Management along with other modern concepts.



COST OF QUALITY (COQ)

The concept of cost of quality has been around for many years. Dr. Joseph M. Juran in 1951 in his *Quality Control Handbook* included a section on COQ. Mr. Philip B. Crosby in his book *Quality Is Free* has popularized the COQ concept.

Quality is concerned with conformance to specification; ability to satisfy customer expectations and value for money. Recognising the importance of cost of quality is important in terms of continuous improvement process. *The cost of control/conformance and the cost of failure of control/non-conformance is the quantitative measure of COQ*. It is the sum of the costs related to prevention and detection of defects and the costs incurred due to occurrences of defects.

Views regarding Cost of Quality

In the past, it was assumed that increased quality is accompanied by increased cost; higher quality means higher cost. Today view of quality cost among practitioners seems fall into three categories:

- *Higher quality means higher cost*
Quality attributes such as performance and features cost more in terms of labour, material, design, and other costly resources. The additional benefits which are gained from improved quality do not compensate for the additional expenses.
- *The resultant savings are greater than the cost of improving quality*
Deming promoted this view, which is still widely accepted in Japan. The savings result from

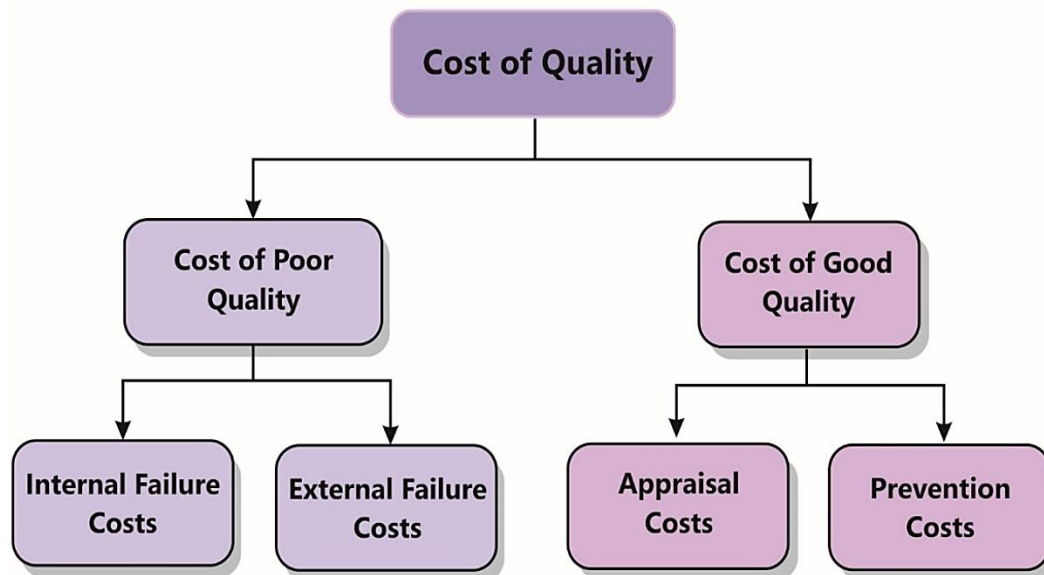
less rework, scrap, and other direct expenses related to defects. Japanese firms made continuous improvements using this philosophy.

- *Quality costs are those incurred in excess of those that would have been incurred if product was built or service performed exactly right the first time*

This view is held by adherents of the TQM philosophy. Here not only direct costs are included, but also those resulting from loss of customers, loss in market share, and many hidden costs and foregone opportunities not identified by modern cost accounting systems.

Components of COQ

Mr. Philip B. Crosby in his book *Quality is Free* referred to the COQ costs in two broad categories namely 'Price of Conformance' and 'Price of Non-conformance'. These two can be bifurcated further in to prevention & appraisal costs and internal & external failure costs. Hence, COQ is often referred as PAF (Prevention, appraisal & failure) model. In other words, '*Price of Conformance*' is known as '*Cost of Good quality*' and '*Price of Non-conformance*' is often termed as '*Cost of Poor Quality*'.



Prevention Costs

The costs incurred for preventing the poor quality of products and services may be termed as Prevention Cost. These costs are incurred to avoid quality problems. They are planned and *incurred before actual operation* and are associated with the design, implementation, and maintenance of the quality management system. Prevention costs try to *keep failure and appraisal cost to a minimum*.

Examples include the costs for:

- Quality planning (creation of plans for quality, reliability, operations, production, and inspection)
- Quality assurance (creation and maintenance of the quality system)
- Supplier evaluation
- New product review
- Error proofing
- Capability evaluations
- Quality improvement team meetings
- Quality improvement projects
- Quality education and training (development, preparation, and maintenance of programs)
- Cost incurred due to product specification arising may be from incoming materials or intermediate processes.

Appraisal Costs

The need of control in product and services to ensure high quality level in all stages, conformance to quality standards and performance requirements is Appraisal Costs. These are costs associated with measuring and monitoring activities related to quality. Appraisal Cost incurred to determine the degree of *conformance to quality requirements* (measuring, evaluating or auditing). They are associated with the *supplier's and customer's evaluation* of purchased materials, processes, products and services to ensure that they are as per the specifications. They could include:

Examples include the costs for:

- Verification (checking of incoming material, process setup, and products against agreed specifications)
- Quality audits(confirmation that the quality system is functioning correctly)
- Supplier rating (assessment and approval of suppliers of products and services)
- Checking and testing purchased goods and services
- In-process and final inspection/test
- Field testing
- Product, process, or service audits
- Calibration of measuring and test equipment

Internal Failure Costs

Internal Failure Cost associated with *defects found before the customer receives* the product or service. Internal failure costs are incurred to remedy defects discovered before the product or service is delivered to the customer. These costs occur when the product is not as per design

quality standards and they are detected before they are transferred to the customer. These are costs that are caused by products or services not conforming to requirements or customer/user needs and are found before delivery of products and services to external customers. Deficiencies are caused both by errors in products and inefficiencies in processes. They could include:

Examples include the costs for:

- Waste- waste occurs when unnecessary work is done or holding of stock as a result of errors, poor organization, or communication
- Scrap—defective product or material that cannot be repaired, used, sold
- Rework or rectification—when the work needs to be rectified for defective material or errors
- Failure analysis—activity required to establish the causes of internal product or service failure
- Delays
- Re-designing
- Shortages
- Failure analysis
- Re-testing
- Downgrading
- Downtime
- Lack of flexibility and adaptability

External Failure Costs

External failure costs are incurred to medicate *defects discovered by customers*. These costs occur when products or services that fail to reach design quality standards are not detected until after transfer to the customer. After the product or service is delivered and then the defects is found then it is an external failure. Further external failure costs are costs that are caused by deficiencies found after delivery of products and services to external customers, which lead to customer dissatisfaction. They could include:

Examples include the costs for:

- Repairs and servicing (of both products that have been returned by the customer and which are serviced at the customer's place)
- Warranty claims (failed products that are replaced or services that are re-performed under a guarantee)
- Complaints (all work and costs associated with handling and servicing customer's complaints)
- Returns (handling and investigation of rejected or recalled products, including transport costs)
- Complaints
- Repairing goods and redoing services

- Warranties
- Losses due to sales reductions
- Environmental costs

The total quality costs are then the sum of all these costs.

$$\begin{array}{c}
 \text{Cost of Quality (COQ)} \\
 = \\
 \text{Cost of Control} \\
 \text{(Prevention Cost + Appraisal Cost)} \\
 + \\
 \text{Cost of Failure of Control} \\
 \text{(Internal Failure Cost + External Failure Cost)}
 \end{array}$$

- In its simplest form, COQ can be calculated *in terms of effort* (hours/days).
- A better approach will be to calculate COQ *in terms of money* (converting the effort into money and adding any other tangible costs like test environment setup).
- The best approach will be to calculate COQ as a *percentage of total cost*. This allows for comparison of COQ across projects or companies.
- To ensure impartiality, an external person say the accountant must determine the Cost of Quality of a project/ product rather than a person who is a core member of the project/ product team (Say, someone from the Accounts Department).

Illustration

Livewell Limited is a manufacturing company that produces a wide range of consumer products for home consumption. Among the popular products are its energy efficient and environment friendly LED lamps. The company has a quality control department that monitors the quality of production.

As per the recent cost of poor quality report, the current rejection rate for LED lamps is 5% of units input. 5,000 units of input go through the process each day. Each unit that is rejected results in a ₹200 loss to the company. The quality control department has proposed few changes to the inspection process that would enable early detection of defects. This would reduce the overall rejection rate from 5% to 3% of units input. The improved inspection process would cost the company ₹15,000 each day.

Required

- ANALYSE the proposal and suggest if it would be beneficial for the company to implement it.*
- After implementation, ANALYSE the maximum rejection rate beyond which the proposal ceases to be beneficial?*

Solution

- (i) Analysis of the proposal to make changes to the inspection process:

The company wants to reduce the cost of poor quality on account of rejected items from the process. The current rejection rate is 5% that is proposed to be improved to 3% of units input.

The expected benefit to the company can be worked out as follows:

The units of input each day = 5,000. At the current rate of 5%, 250 units of input are rejected each day. It is proposed to reduce rejection rate to 3%, that is 150 units of input rejected each day. Therefore, improvements to the inspection process would reduce the number of units rejected by 100 units each day. The resultant cost of poor quality would reduce by ₹20,000 each day (100 units of input × ₹200 cost of one rejected unit).

The cost of implementing these additional controls to the inspection process would be ₹15,000 each day.

The net benefit to the company on implementing the proposal would be ₹5,000 each day. Therefore, the company should implement the proposal.

- (ii) Analysis of maximum rejection rate beyond which the proposal ceases to be beneficial

The cost of improving controls to the inspection process is ₹15,000 each day. The number of units of input processed each day is 5,000. The cost of rejection is ₹200 per unit.

It makes sense to implement the improvements to controls only if the benefit is greater than the cost involved. To find out the point where the benefits equal the cost, solve the following equation

Let the number of reduction in rejections each day due to improved controls be R.

At ₹200 per unit, benefits from reduction in rejection would be ₹200 × R.

At what point, would this be equal to the cost of control of ₹15,000 per day?

Solving ₹200 × R = ₹15,000; R = 75 units. That is if the improvements to inspection process control reduces the number of rejections by 75 units each day, the benefit to the company would be ₹15,000 each day.

That is if the rejection rate improves by 1.5% (75 units / 5,000 units) then the benefits accruing to the company will equal the cost incurred.

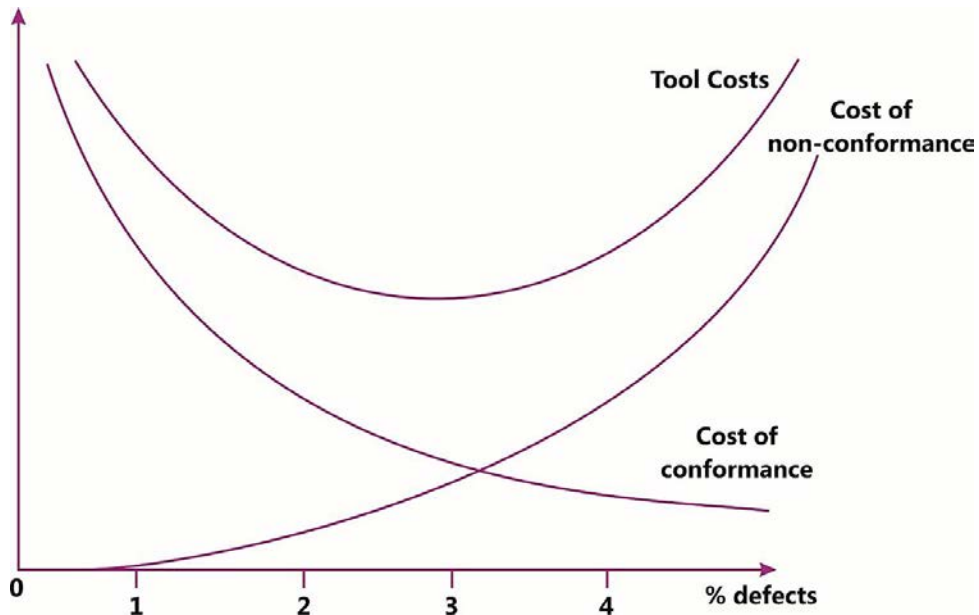
In other words, when the rejection rate is 3.5% (current rate 5% - improvement of 1.5% to the rate) or below, the proposal will be beneficial. In this range, the savings to the cost of poor quality will be more than the cost involved. For example, as explained above, when the improved rejection rate is 3%, the net benefit to the company is ₹5,000 each day.

Beyond 3.5% rejection rate, the proposal will result in savings to the cost of poor quality that is less than the cost involved of ₹15,000 each day.

Optimal COQ

It is generally accepted that an increased expenditure in prevention and appraisal is likely to result in a substantial reduction in failure costs. Because of the trade off, there may be an *optimum operating level* in which the combined costs are at a minimum.

Hence it is further argued that striving for zero defects through a program of continuous improvements is not good for the economic interest of the company.



Case Scenario

JK Ltd. produces and sells a single product. Presently the company is having its quality control system in a small way at an annual external failure and internal failure costs of ₹4,40,000 and ₹8,50,000 respectively. As the company is not able to ensure supply of good quality products upto the expectations of its customers and wants to manage competition to retain market share considers an alternative quality control system. It is expected that the implementation of the system annually will lead to a prevention cost of ₹5,60,000 and an appraisal cost of ₹70,000. The external and internal failure costs will reduce by ₹1,00,000 and ₹4,10,000 respectively in the new system. All other activities and costs will remain unchanged.

Required

- (i) EXAMINE the new quality control proposal and recommend the acceptance or otherwise of the proposal both from financial and non-financial perspectives.
- (ii) What is your ADVICE to the company, if the company wants to achieve zero defect through a continuous quality improvement programme?
- (iii) SUGGEST a suitable quality control level at a minimum cost.

Solution

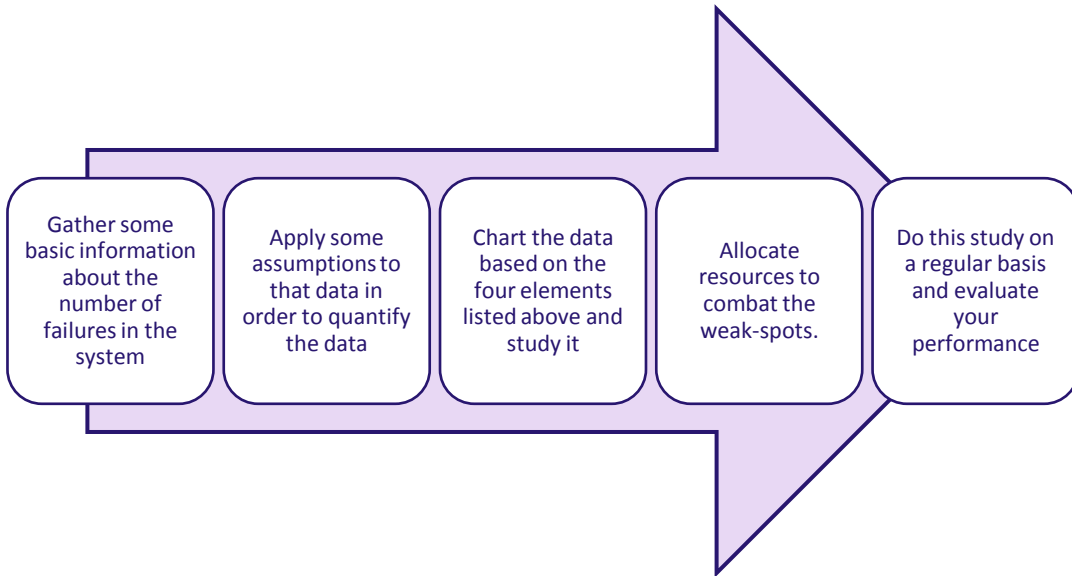
- (i) Implementation of new system will reduce costs of the non - conformance (internal and external failure) by ₹5,10,000 (-40%). However, this will also increase costs of conformance by ₹6,30,000. There is inverse relationship between the costs of the conformance and the costs of non-conformance. JK Ltd. should try to avoid costs of non-conformance because both internal and external failure affect *customer's satisfaction and organisations profitability*. The company should focus on preventing the error such that it ensures that product is of good quality when it reaches the customer at the very first instance. This enhances the customer experience and therefore eliminating the scope for external failures like sales returns and warranty claims. Better quality can yield further sales. Therefore, an increase in spending on quality measures is justified since it not only yields significant improvements to quality but also brings in more sales orders.

Accordingly, from the financial perspective point of view the new proposal for quality control should not be accepted as it will lead to an additional cost of ₹1,20,000 (₹6,30,000 - ₹5,10,000). However, from non-financial perspective point of view as stated above the company should accept the new proposal.

- (ii) It is possible to increase quality while at the same time reducing both conformance and non-conformance costs if a programme of aiming for zero defect/ and or continuous improvement is followed. Zero defect advocates continuous improvement. To implement this elimination of all forms of waste, including reworks, yield losses, unproductive time, over-design, inventory, idle facilities, safety accidents, etc. is necessary.
- (iii) To achieve 0% defects, costs of conformance must be high. As a greater proportion of defects are accepted, however, these costs can be reduced. At a level of 0% defects, cost of non-conformance should be nil but these will increase as the accepted level of defects rises. There should therefore be an *acceptable level of defects* at which the total costs of quality are at a minimum.

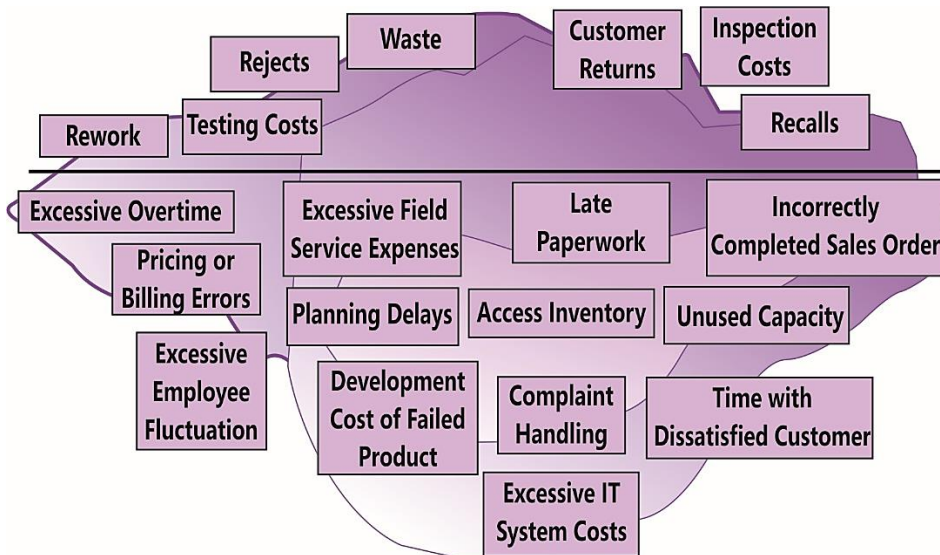
Steps of Application of PAF Model

The prevention, appraisal, and failure (PAF) model is the most widely accepted method for measuring and classifying quality costs. Follow this five-step process.



Conclusion

Many of the costs of quality are hidden and thus making it difficult to identify by formal measurement systems. The iceberg model is very often used to illustrate this matter:



Only a minority of the costs of poor and good quality is obvious – appear above the surface of the water. The reduction of cost under water has a huge scope. If we identify and improve these costs, the costs of doing business will significantly reduce.



TOTAL QUALITY MANAGEMENT (TQM)

Total Quality Management is a management approach that originated in the 1950s and has steadily become more popular since the early 1980s. The concept of Total Quality Management was developed jointly by W. Edwards Deming, Joseph M. Juran, and Armand V. Feigenbaum. TQM is a management philosophy that seeks to integrate all organizational functions (marketing, finance, design, engineering, and production, customer service, etc.) to focus on meeting *customer needs* and organizational objectives.

TQM aims at improving the quality of organizations outputs, including goods and services, through *continual improvement of internal practices*. As part of the TQM approach, standards can be set based on both internal priorities or any industry standards currently in place. It is indeed a joint effort of management, staff members, workforce, and suppliers to meet and exceed customer satisfaction level. Industry standards can be defined at multiple levels, and may include production of items to an understood norm or adherence to various laws and regulations governing the operation of the particular business. It was originally applied in manufacturing areas and used in that for a number of years, TQM is now becoming recognized as a generic management tool and now is applied in service and public sector organizations.

TQM's objectives are to *eradicate waste* and *increase efficiency*. This is done by ensuring that the production of the organization's product (or service) is apt the first time.

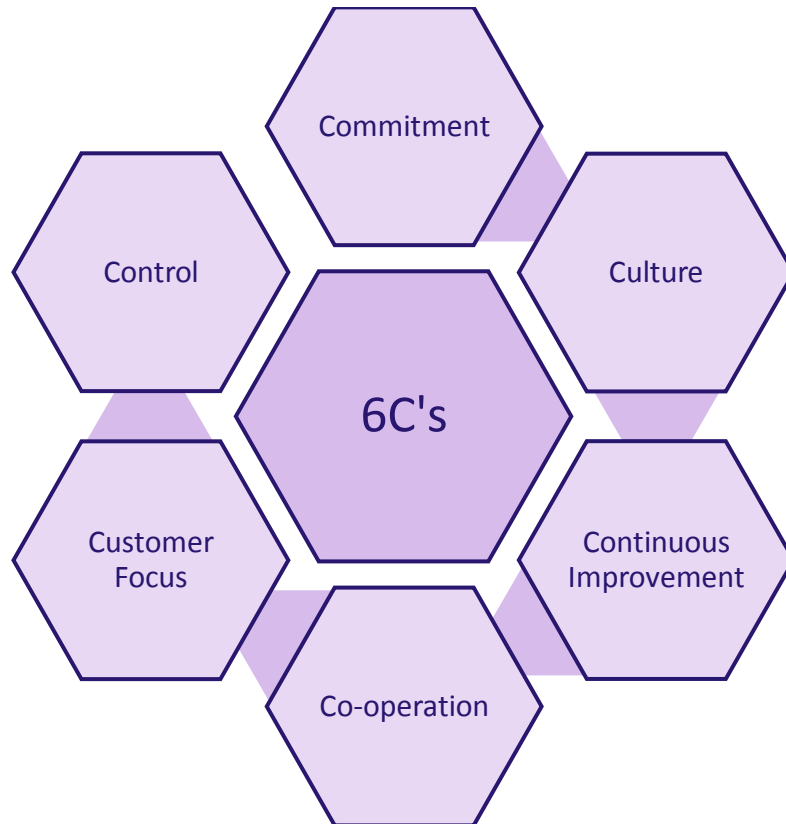
CIMA defines 'Total Quality Management' as "*Integrated and comprehensive system of planning and controlling all business functions so that products or services are produced which meet or exceed customer expectations. TQM is a philosophy of business behaviour, embracing principles such as employee involvement, continuous improvement at all levels and customer focus, as well as being a collection of related techniques aimed at improving quality such as full documentation of activities, clear goal-setting and performance measurement from the customer perspective.*"

Thus, Total Quality Management (TQM) is a management strategy aimed at embedding awareness of quality in all organizational processes. TQM requires that the company maintain this quality standard in all aspects of its business. This requires ensuring that *things are done right the first time* and that defects and waste are eliminated from operations. TQM is a comprehensive management system which:

- Focuses on meeting owner's/ customer's needs, by providing quality services at a reasonable cost.
- Focuses on continuous improvement.
- Recognizes role of everyone in the organization.
- Views organization as an internal system with a common aim.
- Focuses on the way tasks are accomplished.
- Emphasizes teamwork.

Six C's of TQM

The Six Cs for successful implementation of a Total Quality Management (TQM) process is depicted as follows:



- **Commitment:** If a TQM culture is to be developed, so that quality improvement becomes a normal part of everyone's job, a clear commitment, from the top must be provided. Without this all else fails. It is not sufficient to delegate 'quality' issues to a single person since this will not provide an environment for changing attitudes and breaking down the barriers to quality improvement. Such expectations must be made clear, together with the support and training necessary to their achievement.
- **Culture:** Training lies at the centre of effecting a change in culture and attitudes. Management accountants, too often associate 'creativity' with 'creative accounting' and associated negative perceptions. This must be changed to encourage individual contributions and to make 'quality' a normal part of everyone's job.
- **Continuous Improvement:** Recognition that TQM is a 'process' not a 'programme' necessitates that we are committed in the long term to the never-ending search for ways to do the job better. There will always be room for improvement, however small.

- **Co-operation:** The application of Total Employee Involvement (TEI) principles is paramount. The on-the-job experience of all employees must be fully utilised and their involvement and co-operation sought in the development of improvement strategies and associated performance measures.
- **Customer Focus:** The needs of the customer are the major driving thrust; not just the external customer (in receipt of the final product or service) but the internal customer's (colleagues who receive and supply goods, services or information). Perfect service with zero defects in all that is acceptable at either internal or external levels. Too frequently, in practice, TQM implementations focus entirely on the external customer to the exclusion of internal relationships; they will not survive in the short term unless they foster the mutual respect necessary to preserve morale and employee participation.
- **Control:** Documentation, procedures and awareness of current best practice are essential if TQM implementation is to function appropriately. The need for control mechanisms is frequently overlooked, in practice, in the euphoria of customer service and employee empowerment. Unless procedures are in place improvements cannot be monitored and measured nor deficiencies corrected.

Difficulties will undoubtedly be experienced in the implementation of quality improvement and it is worthwhile expounding procedure that might be adopted to minimise them in detail.

Contributions in the field of TQM by 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 organisations 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 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 supplier' Deming stressed that quality improvements cannot happen without organizational change that comes from upper management.

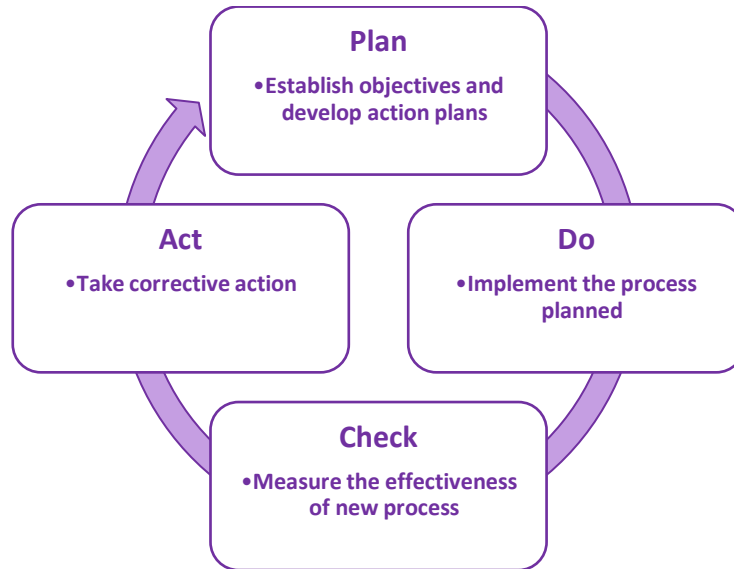
Deming's 14 Points Methodology

1. "Create constancy of purpose towards improvement". Replace short-term reaction with long-term planning.
2. "Adopt the new philosophy". The implication is that management should actually adopt his philosophy, rather than merely expect the workforce to do so.
3. "Cease dependence on inspection". If variation is reduced, there is no need to inspect manufactured items for defects, because there won't be any.
4. "Move towards a single supplier for any one item." Multiple suppliers mean variation between feedstock.
5. "Improve constantly and forever". Constantly strive to reduce variation.
6. "Institute training on the job". If people are inadequately trained, they will not all work the same way, and this will introduce variation.
7. "Institute leadership". Deming makes a distinction between leadership and mere supervision. The latter is quota and target-based.
8. "Drive out fear". Deming sees management by fear as counter-productive in the long term, because it prevents workers from acting in the organisation's best interests.
9. "Break down barriers between departments". Another idea central to TQM is the concept of the 'internal customer', that each department serves not the management, but the other departments that use its outputs.
10. "Eliminate slogans". Another central TQM idea is that it's not people who make most mistakes - it's the process they are working within. Harassing the workforce without improving the processes they use is counter-productive.
11. "Eliminate management by objectives". Deming saw production targets as encouraging the delivery of poor-quality goods.
12. "Remove barriers to pride of workmanship". Many of the other problems outlined reduce worker satisfaction.
13. "Institute education and self-improvement".
14. "The transformation is everyone's job".

The Plan–Do–Check–Act (PDCA) Cycle

Deming developed the Plan – Do – Check – Act cycle. PDCA Cycle describes the activities a company needs to perform in order to incorporate *continuous improvement* in its operation. This

cycle, is also referred to as 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.



Implementation of TQM

Implementation of TQM is a strategic Decision. The first and foremost step in this process involves *collecting the data related to the organization's current reality*. TQM implementation should be delayed till the organization is in a state where TQM is likely to succeed. In case there exist an organisational problem such as a very unstable funding base, weak administrative systems, lack of managerial skill, or poor employee morale, TQM would not be appropriate. Management audit helps in identifying the current levels of organizational functioning and areas in need of change.

Criticisms of Total Quality Management

Some authors, notably Carlzon (1987), Albrecht (1985) and Albrecht and Zemke (1988) have criticised the direction that TQM implementations have tended to take in practice, in particular

- the focus on documentation of process and ill-measurable outcomes;
- the emphasis on quality assurance rather than improvement; and
- an internal focus which is at odds with the alleged customer orientation.

Carlzon has revived the customer focus with an emphasis on total employee involvement (TEI) culminating in the empowerment of the 'front-line' of customer service troops. The main features of his empowerment thrust has been:

- loyalty to the vision of the company through the pursuit of tough, visible goals;
- recognition of satisfied customers and motivated employees as the true assets of a company;

- delegation of decision-making to the point of responsibility by eliminating hierarchical tiers of authority to allow direct and speedy response to customer needs; and
- decentralisation of management to make best use of the creative energy of the workforce.

Albrecht suggest that TQM may not be appropriate for service based industries, because the standards-based approach of 'industry best practice' ignores the culture of organisations. He recommends a move towards TQS (total quality service), which is more customer oriented and creates an environment to promote enthusiasm and commitment. Albrecht suggests that poor service is associated with sloppy procedures, errors, inaccuracies and oversights and poor co-ordination, all of which represents improvement opportunities which can be achieved through tighter controls.

Conclusion

There is no single theory on TQM, but Deming, Juran and Ishikawa provide the core assumptions, as a *"discipline and philosophy of management which institutionalizes planned and continuous improvement and assumes that quality is the outcome of all activities that take place within an organization; that all functions and all employees have to participate in the improvement process; that organizations need both quality systems and a quality culture."*

To successfully implement TQM immense efforts, time, courage, and patience is required. Successful implementation of TQM results in improved quality across all major processes and departments, higher customer retention, higher revenue on account of improved sales, and global brand recognition.

While TQM shares much in common with the Six Sigma improvement process, it is not the same as Six Sigma. TQM focuses on process improvements, while Six Sigma looks to reduce defects.

TQM in Practice

Tata Steel

Tata Steel has maintained the confidence to improve performance globally even in the face of a challenging economic climate in which the steel industry happens to be severely affected. One factor that contributes to this confidence is the Company's adherence to Total Quality Management (TQM) to achieve its goals. Since the formal incorporation of TQM for Business Excellence in the late 1980's Tata Steel has adopted a number of improvement initiatives popular around the world. At Tata Steel's European operations, Continuous Improvement activities are focused on providing Business Units with the ability to drive business through Lean Management, a common strategy deployment process, training of CI coaches and knowledge sharing through operations.

NatSteel maintains a systematic approach towards improving productivity and enhancing quality while reducing cost at the same time. The Singapore operations concentrated on yield improvement, reduction in power consumption and a significant bottom line benefit. The Xiamen operations have also adopted measures to reduce vulnerability caused by price fluctuations.

With the Company's better understanding of TQM and the Theory of Constraints (TOC) on the

Deming Application Prize journey, its customer focus and market orientation have undergone a sea-change. Tata Steel has initiated a culture of value creation with customers and suppliers. Specific approaches focus on the 'needs' of the customer as opposed to 'wants'. Programmes include those on Customer Value Management, Retail Value Management, and Solution for Sales and Supplier Value Management. The Company emphasises effective daily work management practices, a clean and safe work environment and consistency and stability of processes as important factors in sustaining development and growth.

In the face of high raw-material price volatility and an overall trend of rapidly increasing prices, in 2009-2010 the procurement Division of Tata Steel India focused its efforts on keeping these trends in check by leveraging long-term contracts and relationships, and on minimising risk by hedging and through various other strategic sourcing tools, including innovations and improvement initiatives using Total Quality Management precepts.

Tata Steel is the first integrated steel company in the world, outside of Japan, to win the Deming Application Prize. The steel giant won the 2008 prize for achieving distinctive performance improvements through the application of total quality management (TQM).

General Electric Company and Motorola Inc.

Today's customers demand and expect high quality. Companies that do not make quality a priority risk long-run survival. World-class organizations such as General Electric and Motorola attribute their success to having one of the best quality management programs in the world. These companies were some of the first to implement a quality program called, Six Sigma, where the level of defects is reduced to approximately 3.4 parts per million. To achieve this, everyone in the company is trained in quality. For example, individuals highly trained in quality improvement principles and techniques receive a designation called "Black Belt." The full-time job of Black Belts is to identify and solve quality problems. In fact, Motorola was one of the first companies to win the prestigious Malcolm Baldrige National Quality Award in 1988, due to its high focus on quality. Both GE and Motorola have had a primary goal to achieve total customer satisfaction. To this end, the efforts of these organizations have included eliminating almost all defects from products, processes, and transactions. Both companies consider quality to be the critical factor that has resulted in significant increases in sales and market share, as well as cost savings.



THE BUSINESS EXCELLENCE MODEL

Business Excellence (BE) is a philosophy for developing and strengthening the management systems and processes of an organization to improve performance and create value for stakeholders. The essence of this approach is to *develop quality management principles* that increase the overall efficiency of the operation, minimize waste in the production of goods and services, and help to increase employee loyalty as a means of maintaining high standards throughout the business by *achieving excellence in everything* that an organization does (including leadership, strategy, customer focus, information management, people, and processes).

Business excellence principles emerged because of development of quality drive into traditional business management. Business excellence considers various management thoughts as core concepts and structures quality management in a manner that can be adapted by any enterprise. Several business excellence models exist world-wide. While variations exist, these models are all *remarkably similar*. The most common include;

- EFQM Excellence Model
- Baldrige Criteria for Performance Excellence
- Singapore BE Framework
- Japan Quality Award Model
- Australian Business Excellence Framework

Few of the models mentioned above having strategic importance in the process of organizational development have been discussed here.

EFQM Excellence Model¹

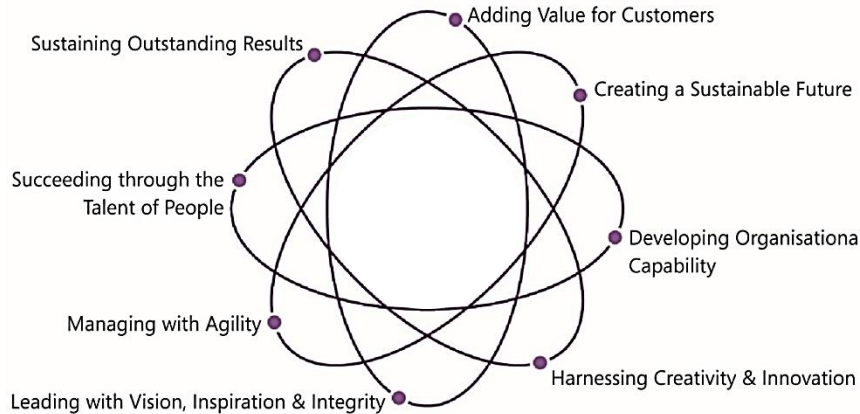
EFQM Excellence Model meets the Fundamental Concepts of excellence well. It is European model but is closely related to other models such as the US Model Malcolm Baldrige Model. The Baldrige model has the same aims and very similar framework.

The EFQM Excellence Model provides an all-round view of the organisation and it can be used to determine how different methods fit together and complement each other. Based on the needs of the organisation, this model can be used with other tools of improvement to attain sustainable excellence.

The EFQM model is a practical, non-prescriptive tool that enables organizations to understand the cause and effect relationships between what their organisation does and the results it achieves. The EFQM model presents set of three integrated components:

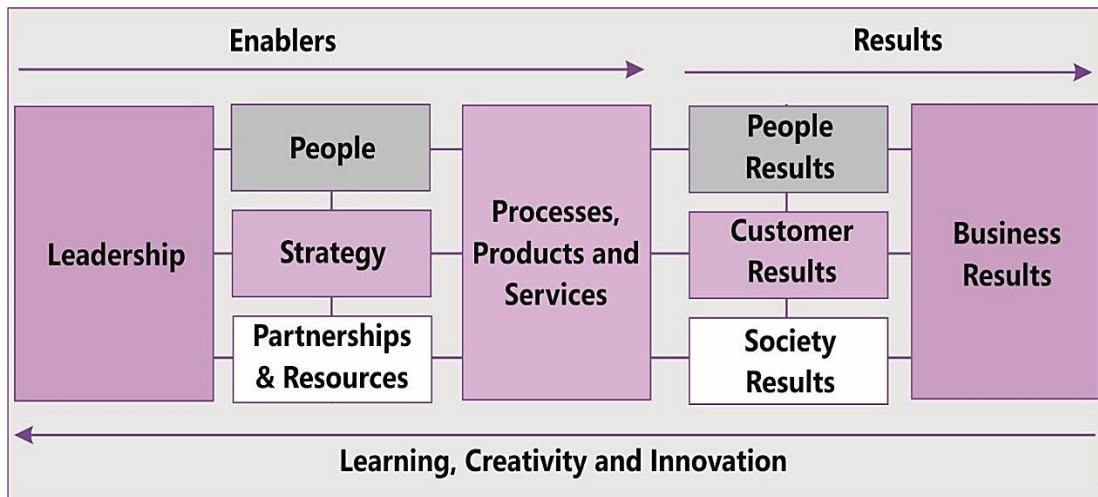
- The Fundamental, concepts of excellence
- The Criteria, conceptual framework
- The RADAR, logic assessment framework

The *fundamental Concepts of Excellence* are the basic principles that describe the essential foundation for any organization to achieve sustainable excellence. These fundamental concepts can be seen in below figure:



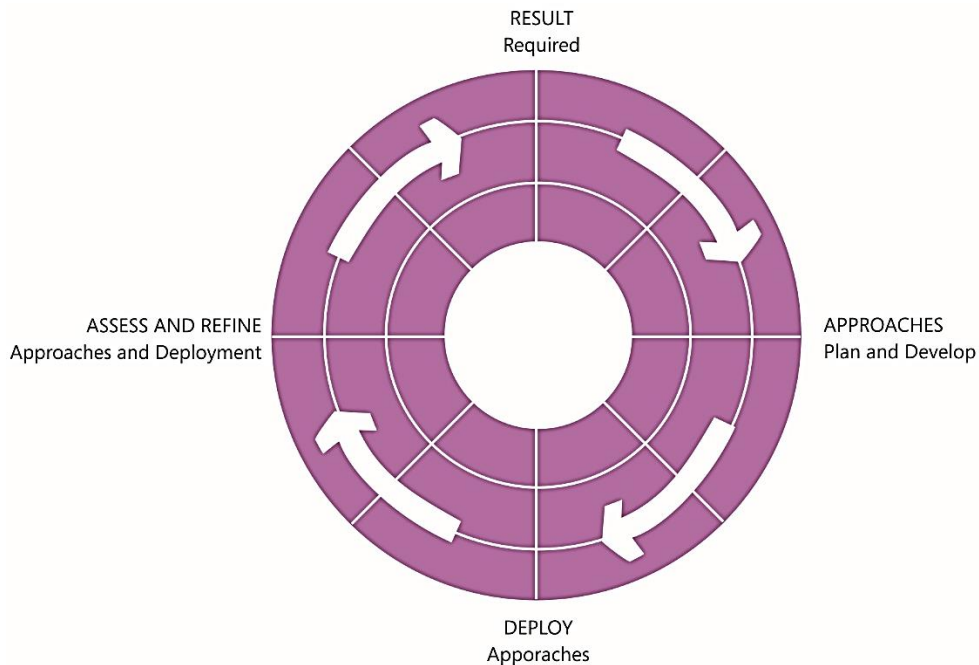
The EFQM Excellence Model Criteria

The EFQM conceptual model helps organizations to realize in practice the fundamental concepts and to understand the cause- and-effect relationships between what the organization does and the results it achieves. The EFQM Excellence Model is also a self-assessment model for an organization that wants to assess its level of excellence. It is based on nine criteria. There are five 'Enablers' and four 'Results'. The 'Enabler' criteria cover what an organisation does. The 'Results' criteria cover what an organisation achieves. 'Results' are caused by 'Enablers'.



The dynamic nature of the model is emphasised by the arrows as shown in the diagram. The model helps the enablers by innovation and learning leading to improved results. The Model's nine boxes, shown above, represent the criteria against which to assess an organisation's progress towards excellence. Each criterion consists of a number of sub-criterion, including the elements that need to be considered for the organization to achieve excellence in its business, and which are indicative of what can be considered good practice; these are further evaluated using the RADAR logic assessment framework.

The last component is the RADAR (results-approaches-deploy-assess-refine) logic, which is a management and evaluation tool for analysing the performance of an organization (refer below figure).



It is used as an underlying basis of the scoring system of the EFQM Excellence Award and can help to lead changes and manage improvement projects.

The EFQM Excellence Model is used by about 30,000 organizations across Europe. Recently, more and more countries especially across Middle East and South America, have started using the model.

(1. Source: EFQM, <http://www.efqm.org/>)

Baldrige Criteria for Performance Excellence

This model provides the foundation for most of the business excellence models adopted around the world. The framework is build round the seven categories i.e.,

- Leadership,
- Strategic planning,
- Customer and market focus,
- Measurement analysis and knowledge management,
- Workforce,
- Process management and
- Business results.

Business Excellence Model and Organizational Culture²

Business Excellence approach focuses on strengthening the internal function and communication, looks towards the cultivation of strong ties with consumers and can be incorporated into the culture.

Excellence cannot be attained if the staffs are forced to conform to certain norms. They have to be critically managed and motivated. A wisdom is required to be developed among employees that by pursuing the goal of their organization they are meeting their own objectives. Employees feel accredited when they are considered important elements in pursuit of excellence as they learn new skills.

A feeling of association is developed and employees start believing in the management philosophies when the organization tries to achieve excellence. For achieving business excellence effective leadership is equally important to manage all the resources efficiently.

A strong and empathetic leader, effective communication system, employee empowerment, employee motivation, innovative and creative culture are some of the strategies to make the employees feel connected to the management philosophy of the organization.

A robust culture arises as a result of implementation of business excellence model, which can make the organization a world class performer.

(2. Source: *Quality Management Practices for Global Excellence* edited by Alok Bansal, Yogeshwari Phatak, Raj Kishore Sharma)

Business Excellence Model in Practice

Tata Business Excellence Model

The TBEM which has been adapted on the pattern of Malcolm Baldrige Criteria in the business excellence movement. The model has provided Tata companies with a framework for assessing their businesses holistically, and adopting measures to improve their competitive strength, financial performance and operational efficiencies. The TBEM assesses seven core aspects of business operations i.e., leadership, strategic planning, customer and market focus, measurement, analysis and knowledge management, human resource focus, process management and business results. The essence of this framework is a proactive attitude rather than a reactive one. It talks about keeping the business flexible and running it effectively and efficiently.



THEORY OF CONSTRAINTS³

During the 1980s Goldratt and Cox advocated a new approach to production management called optimised production technology (OPT). OPT is based on the principle that profits are expanded by increasing the throughput of the plant. The OPT approach determines what prevents throughput being higher by distinguishing between bottleneck and non-bottleneck resources. This approach advocates that *bottleneck resources/activities should be fully utilised while non-bottleneck resources/activities should not be utilized to 100% of their capacity since it would result in increase in inventory.*

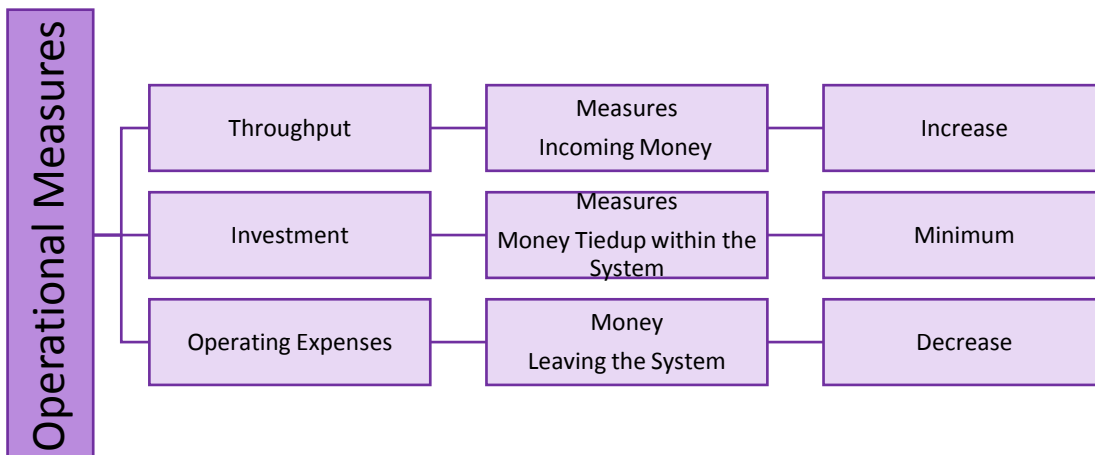
The concept behind the system was first formulated and developed by Goldratt and Core (1986) in USA. Goldratt developed the concept and eventually gave it the name the Theory of Constraints (TOC).

Operational Measures of Theory of Constraints

The theory of constraints focuses on revenue and cost management when faced with bottlenecks. It advocates the use of three key measures. These are:

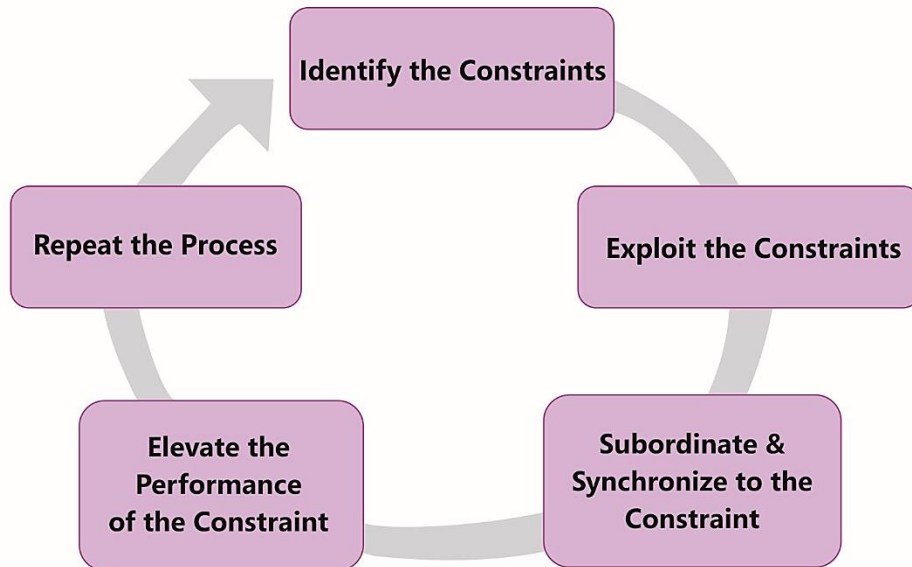
Core Measures	Definition
Throughput (T)	<ul style="list-style-type: none"> Throughput as a TOC measure is the rate of generating money in an organization through Sales. Throughput = (Sales Revenue – Unit Level Variable Expenses)/ Time Direct Labour Cost is viewed as a fixed unit level expenses and is not usually included.
Investment (I)	<ul style="list-style-type: none"> This is money associated with turning materials into Throughput and do not have to be immediately expensed. Includes assets such as facilities, equipment, fixtures and computers.
Operating Expense (OE)	<ul style="list-style-type: none"> Money spent in turning Investment into Throughput and therefore, represent all other money that an organisation spends. Includes direct labour and all operating and maintenance expenses

Based on these three measures, the objectives of management can be expressed as increasing throughput, minimizing investment and decreasing operating expenses.



Goldratt's Five-Step Method for Improving Performance

The theory of constraints describes the process of identifying and taking steps to remove the bottlenecks that restrict output. The theory of constraints considers short-run time horizons and assumes other current operating costing to be fixed costs. The key steps in managing bottleneck resources are as follows:



1. **Identifying the System Bottlenecks:** This step involves identification of constraints which restrict output from being expanded.
2. **Describe How to Exploit the Bottlenecks:** Having identified the bottlenecks it becomes the focus of attention since only the bottleneck can restrict or enhance the flow of products. It is therefore essential to ensure that the bottleneck activity is fully utilised. Decision regarding the optimum-mix of products to be produced by the bottleneck activity must be made.
3. **Subordinate Everything Else to the Decision in Step-2:** This step requires that the *optimum production of bottleneck activity should determine the production schedule of the non-bottleneck activities.*

Let us consider an organisation dealing with a product which requires multiple parts and processed on different machines. With multiple parts in a product, dependencies arise among operations; some operations cannot be started until parts from previous operations are available. Waiting time appear for two reasons:

- Parts that require processing at a bottleneck machine must wait in line until the bottleneck machine is free, and
- Parts made on non-bottleneck machines must wait until parts coming off the bottleneck machines arrive.

Therefore, the workers of non-bottleneck machines should not be motivated to improve their productivity if the additional output cannot be processed by bottleneck machine. *Producing more non-bottleneck output results in increase in WIP inventories and no increase in sales volume.* Therefore, the preferred course of action is that bottleneck machine should setup pace for non-bottleneck machine.

4. **Elevate the System Bottlenecks or Increase Bottleneck Efficiency and Capacity:** This step involves taking action to remove (that is elevate) the constraint. This might involve replacing a bottleneck machine with a faster one or providing additional training for a slow worker or changing of the design of the product to reduce the processing time required by a bottleneck activity.
5. **Repeat the Process as a New Constraint Emerges:** If the bottleneck activity has been elevated and replaced by a new bottleneck activity it is necessary to return to step 1 and repeat the process.

(3.Sources: *Cost Management: Accounting and Control* By Don Hansen, Maryanne Mowen, Liming Guan; *Management and Cost Accounting* By Colin Drury)



THROUGHPUT ACCOUNTING

The concept of Throughput Accounting (TA) was created by David Galloway and David Waldron (1988-89) from the theory of constraints. In their opinion, accounting should monitor the rate at which businesses make money. With this important goal in mind, they focused on the *return per product per bottleneck hour*. They treated only direct material as variable and all labour and overhead costs as fixed. Several ratios were defined by Galloway and Waldron based on the definition of throughput.

Throughput Accounting Ratio:

$$\frac{\text{Throughput per Bottleneck Minute}}{\text{Factory Cost per Bottleneck Minute}}$$

Note

Galloway and Waldron define factory cost in the same way that Goldratt defines operating expense. See throughput.

If the TA ratio is greater than 1 the product in question is “profitable” because, if all capacity were devoted to that product, the throughput generated would exceed the total factory cost. If there was a bottleneck products could be ranked by a variant of the TA ratio (although the ranking is the same as that derived by the use of throughput per bottleneck minute).

Other Performance Ratios suggested include:

$$\frac{\text{Throughput}}{\text{Labour Cost}} \text{ and } \frac{\text{Throughput}}{\text{Material Cost}}$$

Illustration

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 Z
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

- Company adopted throughput accounting and products are ranked according to 'product return per minute'. Select the highest rank product.
- CALCULATE throughput accounting ratio and COMMENT on it.

Solution**(i) Calculation of Rank According to 'Product Return per minute'**

Particulars	X	Y	Z
Selling Price	66	75	90
Variable Cost	24	30	40
Throughput Contribution	42	45	50
Minutes per unit	15	15	20
Contribution per minute	2.8	3	2.5
Ranking	II	I	III

(ii) Ranking Based on 'TA Ratio'

Contribution per minute	2.80	3.00	2.50
Factory Cost per minute (2,21,600 / 75,120)	2.95	2.95	2.95
TA Ratio (Cont. per minute / Cost per minute)	0.95	1.02	0.85
Ranking Based on TA Ratio	II	I	III

Comment

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

Advantages and Disadvantages

Advantages	Disadvantages
Reduction in inventory.	Focus on short-term goals as opposed to long-term with ABC.
More productive machines.	Main emphasis on increasing sales and volume, not quality as opposed to Total Quality Management.
Ability to meet shorter lead times.	Might result in loss of the overall picture while looking at specific constraints.
More flexible.	Focuses on the push approach as opposed to pull approach of JIT.
Better customer service.	Valid only if applied to the total supply chain process including management, production, resources and support.
Better product mix.	Dependent on circumstances, operating expenses under TOC/TA are regarded as fixed, which is simplistic in the view of detractors. Therefore, TOC and TA are basically the same thing as variable costing.
Better customer relationship.	

Conclusion

TOC/TA-based approach as a direct costing approach may be more suitable for short term product mix decisions. This approach is clear than approaches that allocate indirect costs more or less arbitrarily (Boyd and Cox, 2002). On balance, it may be considered that TOC should not be ignored due to the comprehensibility of the approach. TOC is a tool and not a philosophy.

Theory of Constraints in Practice

Sunshine PTE Ltd., Singapore
<p>Sunshine PTE Ltd. produces parts for automotive. Its primary measure of productivity is labour absorption under the assumption that if more work is being done to create inventory, profits will increase. However, using this measure resulted in actions to increase inventory and build stock products rather than fill actual customer orders.</p>
<p>Process improvements (like Lean Sigma initiatives) were implemented to reduce costs. Efforts were made to decrease the labour involved in producing parts. This was done for all operations. Many non-constraints became faster, producing even more work than the constraints could handle. Even though labour went down, inventory increased and it became more difficult to fulfill orders on time and to properly prioritize manufacturing jobs.</p>
<p>When management learned about throughput, it shifted its focus from absorbing costs into</p>

inventory to increasing how quickly work could be completed. Emphasis was given to improving constraints. By investing \$89,000 in the facility and adding 3 additional workers to the day shift, output increased by 83%. Under traditional Cost Accounting, these expenses would not have been justified because local output efficiency would have declined on a per labour hour basis. However, the cost was minimal compared to the increase in throughput.



SUPPLY CHAIN MANAGEMENT

A complete chain of serving the customers or consumer whether linked or interdependent is the composition of supply chain. It comprises of vendors that supply raw material, producers who convert the material into products, warehouses that store, distribution centers that deliver to the retailers and retailers who sell the product to the ultimate user.

Supply chains encourage value-chains because, without them, no producer has the ability to give customers what they want, when and where they want, at the price they want. Deficiencies in supply chain reduces the ability of the producers to compete with each other.

The term supply chain can be referred to as the entire network of organisations working together to design, produce, deliver and service products. *In other words all activities associated with the flow and transformation of goods from raw material to end user- is called supply chain.*

The transformation of product from node to node includes activities such as

- Production Planning
- Purchasing
- Material Management
- Distribution
- Customer Service
- Forecasting

The Global Supply Chain Forum (GSCF) defines Supply chain management as the “*integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders*”.

The following eight supply chain management processes are included in the GSCF framework:

- **Customer Relationship Management**, to manage and analyse customer's interaction and data throughout the life cycle with the main motive of improving business relations.
- **Supplier Relationship Management**, provides the structure for how relationships with suppliers are developed and maintained.
- **Customer Service Management**, provides the key points of contact for administering product and service agreements.

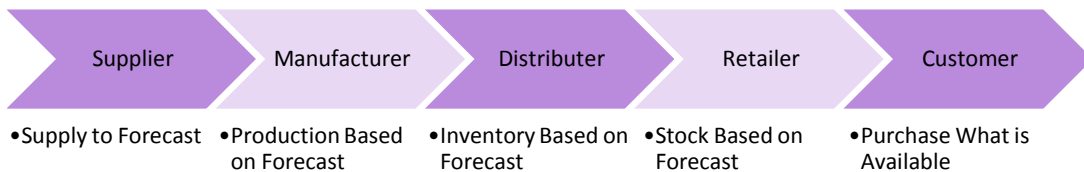
<ul style="list-style-type: none"> ▪ Demand Management, provides the structure for optimising the customer's requirements with supply chain capabilities.
<ul style="list-style-type: none"> ▪ Order Fulfilment, includes all activities necessary to define customer requirements, design the logistics network, and fill customer orders.
<ul style="list-style-type: none"> ▪ Manufacturing Flow Management, includes all activities necessary to move products through the plants and to obtain, implement and manage manufacturing flexibility in the supply chain.
<ul style="list-style-type: none"> ▪ Product Development and Commercialization, provides the structure for developing and bringing to market new products jointly with customers and suppliers.
<ul style="list-style-type: none"> ▪ Returns Management, includes all activities related to returns, reverse logistics, gatekeeping, and avoidance.
<p><i>(Source: Supply Chain Management: Processes, Partnerships, Performance By Douglas M. Lambert)</i></p>

Types of Supply Chain- Push and Pull

During the traditional chain suppliers were at one end. Suppliers give their products to manufacturer or distributors who further send it to retailers. Although customers are the source of the profits, they are at the end of the chain in the 'push' model.

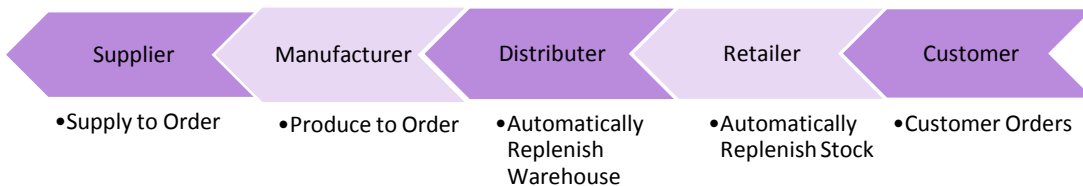
Under Push model stocks are produced on the basis of anticipated demand. Demand forecasting can be done via a variety of sophisticated techniques may be from operations research area or data mining.

Push Model



Under Pull model stocks are produced in response to the actual demand. This new business model is less products centric and more directly focused on the individual consumer – a more marketing - oriented approach.

Pull Model



Electronic connections are used in the pull model to bring out the needs of customers.

- Electronic supply chain connectivity gives end customers the opportunity to give direction to suppliers, for example about the precise specifications of the products they want.
- Ultimately, customers have a direct voice in the functioning of the supply chain.

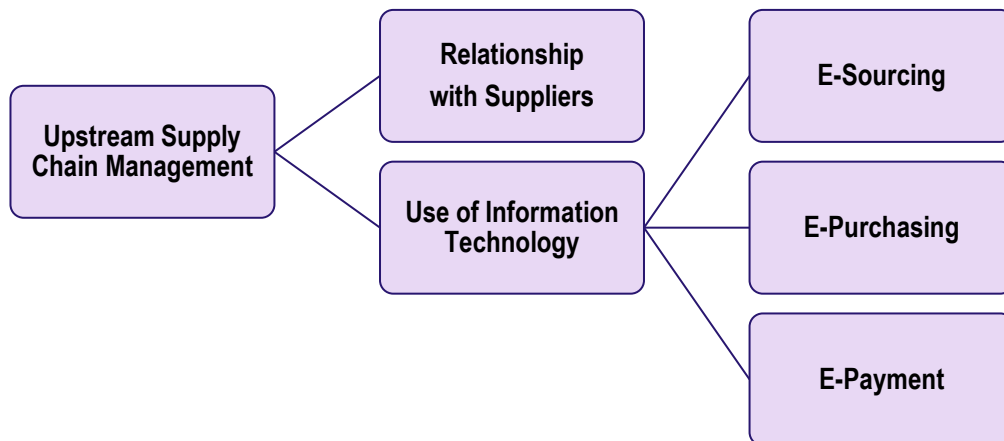
Supply chain created through E-Commerce brings benefit to both customer and manufacturer. Thus, facilitating the companies to fulfil the customer needs, carry fewer inventories, and send products to market more quickly.

Upstream and Downstream Flow

A supply chain begins right from the supplier and finally ends on end customer or consumer. In the total chain there are flows of material, information and capital or finance. *When the flow relates to supplier it is termed as upstream flow. If the flow is with consumers or customers it is named as downstream flow.*

Management of Upstream Supplier Chain

Management of transactions with suppliers are termed as upstream supply chain management.



Relationship with Suppliers

Supplier Relationship Management (SRM) is undergoing a major transition. In today's global economy there are so many factors to consider when choosing and managing a supplier. Supplier capabilities of innovation, quality, reliability and costs/price reductions and agility to reduce risk factors all have witnessed significant changes when aligned with key suppliers. Greater value can be achieved for both businesses, something that would be difficult to achieve if operating independently.

Supplier Strategy:

To possess a commendable influence on the whole upstream flow, organization has to build up a set of strategies which in turn results in control over suppliers. This strategy is likely to take account of matters such as the following:

Sources

Location and availability of source. The bargaining power of buying organization depends on that whether the suppliers' businesses larger or smaller than the buying organization. In the era of globalization companies choose suppliers from different parts of world.

Number of Suppliers

In the event the buying company wants to avail huge discount bulk purchase from single supplier is advisable. However, if requirement is to avoid the risk of failed deliveries organization may prefer several or multiple suppliers.

Cost, Quality, and Speed of Delivery

These factors are closely interrelated and the strategy will probably need to make compromises to achieve the right balance.

Make or Buy and Outsourcing

Depending upon the application of various strategic cost management techniques, decision on to produce or to outsource.

Use of Information Technology

The main activities of upstream supply chain are *procurement* and *logistics*. In modern business environment upstream supply chain management use **E-Procurement** process. E-Procurement is the electronic methods beginning from identification of the organization's requirements and end on payment. E-Procurement includes E-Sourcing, E-Purchasing and E-Payment.

E-Sourcing

In E-Sourcing organization provide electronic invitation to tenders and request them to submit their quotations. Especially organization which may opt to choose tenders from different countries. E-Sourcing is the *best possible way to find out the best supplier* among others. This process reduces the cost, time and effort associated with the selection of supplier than it is required in traditional method.

E-Purchasing

In recent years, organizations are shifting from centralized purchasing to decentralization. Usage of technology has resulted in lesser time, lower cost & better result in *product selection* and *ordering*. Features of an E-Purchasing system include:

- Electronic catalogues for core/standard items.
- Recurring requisitions/shopping lists for regularly purchased items. The standard shopping lists form the basis of regular orders and the lists can have items added or deleted for each specific order.
- Electronic purchase orders dispatched automatically through an extranet to suppliers.
- Detailed management information reporting capabilities.

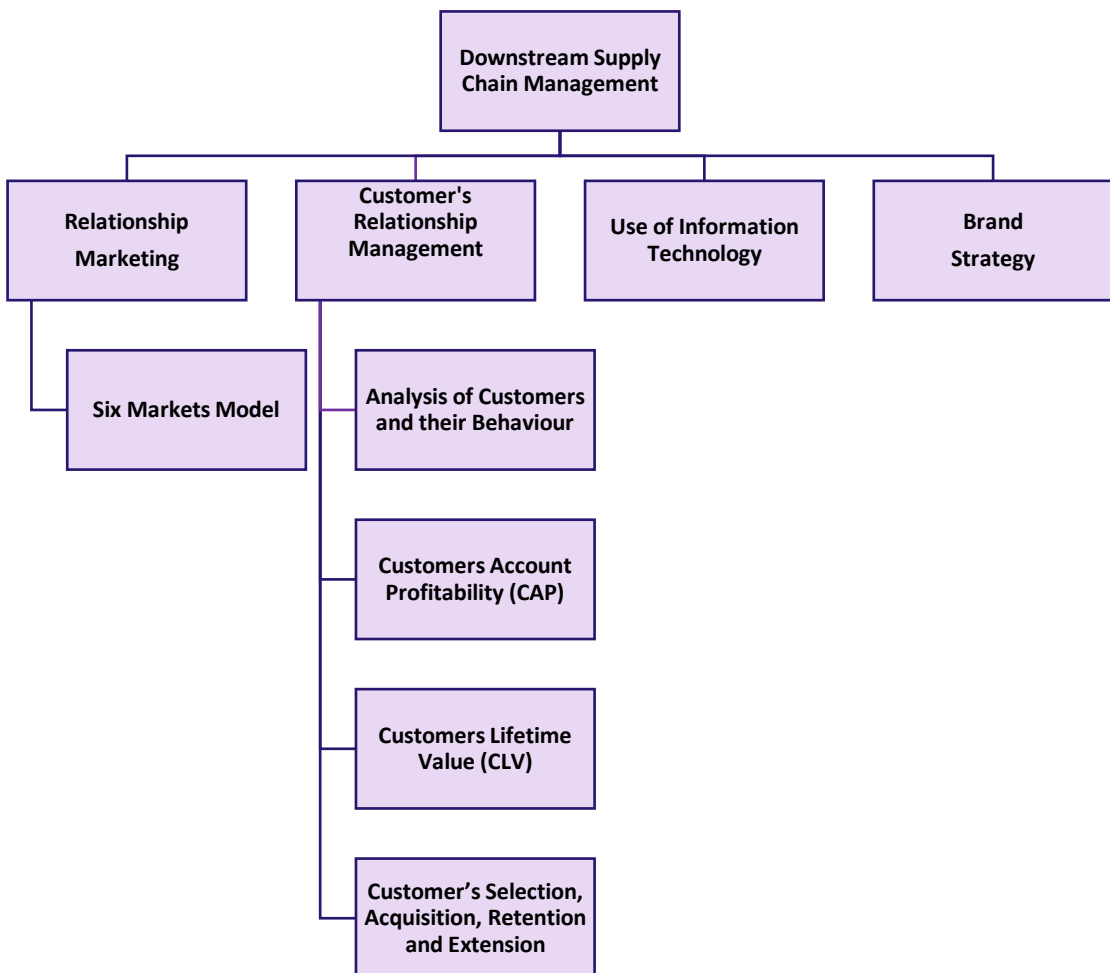
E-Payment

After purchasing from the best possible supplier payment also takes place through *electronic mode i.e. invoicing and fund transfer*. E-Payment results in faster payment with zero error which is expected in manual form.

E-Procurement is beneficial for organization as it results in lower cost, lesser time, quick ordering, selection of best supplier, control over inventory, better purchase and sales, greater financial transparency etc. even a small problem in technology can crash the whole system in few moments.

Downstream Supply Chain Management

Management of transactions with consumers or customers are termed as downstream supply chain management.



Relationship Marketing

Marketing plays a vital role to successfully handle the downstream supply chain management. *The Relationship marketing helps the organization to keep existing customer and to attract new customers through helpful staff, quality service / product, appropriate prices and proper customer care etc.*

Six Markets Model⁴ identifies the six key “market domain” where organizations may consider directing their marketing activities.

Internal Markets

Internal Markets are the crucial requirement for the success of relationship marketing. Internal markets include internal departments and staff. Staff have the ability to determine *customer oriented corporate culture*.

Referral Markets

Referral Markets include two main categories: *existing customers who recommend their suppliers to others* and *referral sources* such as a consultancy firm that may refer work to a law firm.

Influence Markets

Influence Markets represent entities and individuals, which have the ability to influence the marketing environment of a firm may include financial analysts, shareholders, the business press, the government, and consumer groups. *A good relationship needs to be developed by the firms with critical sources of influencers relevant to their markets.*

Recruitment's Markets

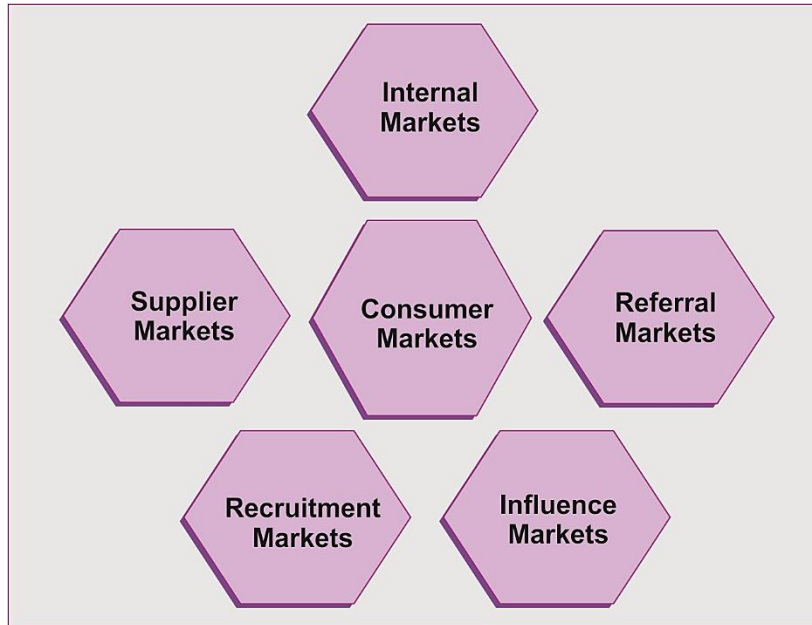
Recruitment Markets are focal point for relationship marketing. Firms have to manage its relationships with recruitment markets such as commercial recruitment agencies, universities and institutes in order to have access to potential employees who possess the *required skills* for the job position.

Supplier's Markets

Supplier Markets refer to traditional suppliers as well as organizations with which the firm has some form of strategic alliance to gain benefits such as better quality, faster reach-to-market, original and creative products, and lower levels of inventory.

Customer's Markets

Customer Markets represent all existing and prospective customers as well as intermediaries. They can be either consumers or intermediaries. In today's environment, the way firms provide services affects the market and helps in gaining customers.



The six markets model suggests that a firm must regulate its actions towards developing appropriate relationships with each of the market areas as the management of relationships in each of the six markets is critical for the attainment of *customer retention* objective.

(4. Reference: *Customer Relationship Management Strategies in the Digital Era* edited by Nasir, Suphan)

Gordon (1998) states that there are six dimensions that illustrate how relationship marketing differs from the historical definition. These are that:

- Relationship marketing seeks to create *new value for customers* and then share it with these customers.
- Relationship marketing recognises the key role that customers have both as purchasers and in defining the value they wish to receive.
- Relationship marketing businesses are visualised to design and align process.
- Relationship marketing represents *continuous cooperative effort* between buyers and sellers.
- Relationship marketing recognises the *value of customer's purchasing lifetimes* (i.e. Customer Lifetime Value).
- Relationship marketing even searches for the *chain of relations* that can be drawn within the organisation. Customer's wants and values are created between the organisation and its main stakeholders, including suppliers, distribution channels, intermediaries, and shareholders.

The growing interest in relationship marketing suggests a shift in the nature of marketplace transactions from discrete to relational exchanges, from exchanges between parties with no past history and no future to interactions between parties with a *history and plans for future interaction*.

Customers Relationship Management

To manage and analyse customer's interaction and data throughout the life cycle with the main motive of improving business relations the strategies and technologies used is Customer Relationship Management (CRM). Relation includes relations with customers, assisting in customer retention and driving sales growth. Customers under different channels are compiled through CRM. The staff dealing with customers get a detailed information about customer's personal information, purchase history, buying preferences and concerns. Organizations must ensure customers are satisfied with their products and services for higher customer retention. Remember one satisfied customer brings ten new customers with him where as one dissatisfied customer takes away ten customers along with him. In simpler words, CRM is knowing the needs of the customers and providing them with best possible solution.

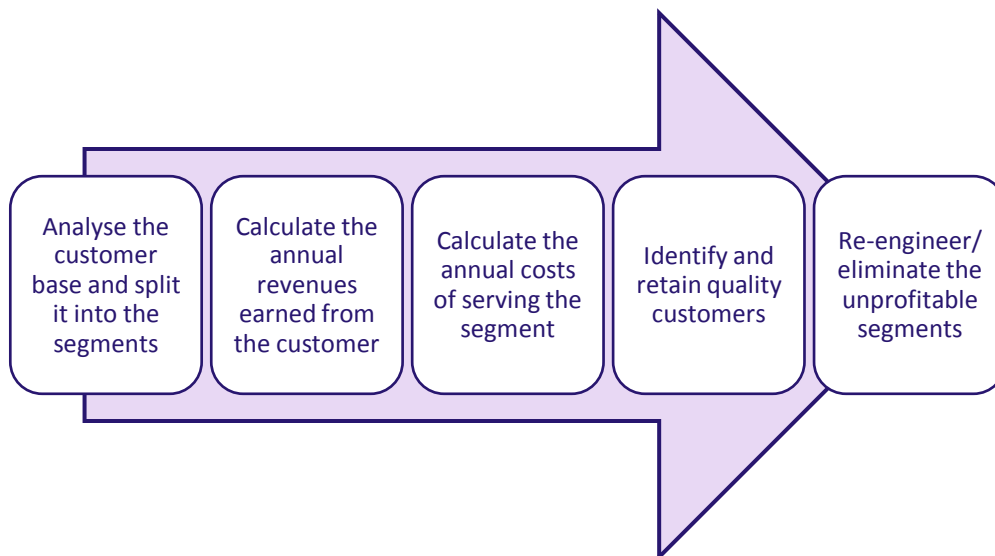
Analysis of Customers and their Behaviour

Analysis of customers is necessary based on geographical location or purchasing characteristics. For industrial customer expectation of benefits - quality, discount, serviceability, size of the should be taken into consideration. During such analysing process, management should keep in mind the physiological need, safety need, social need, status/ ego need and self-fulfilment need of existing and future customers.

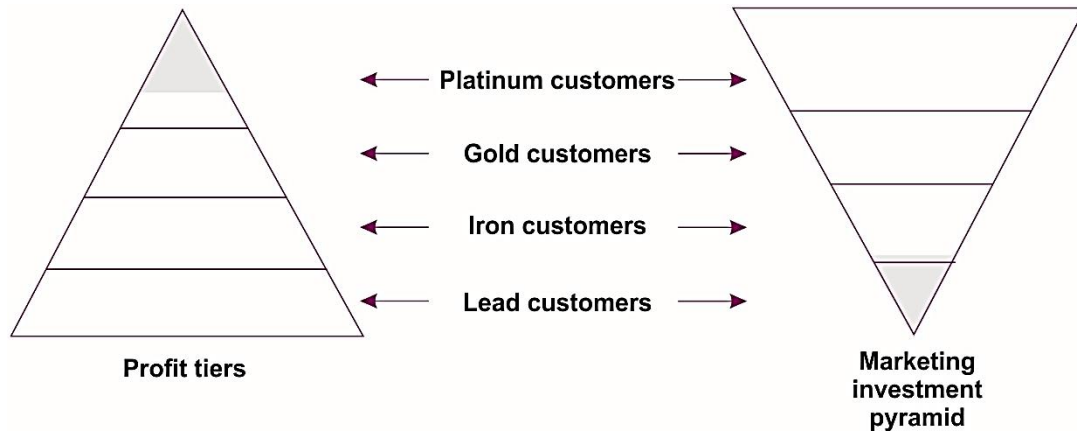
Customers Account Profitability (CAP)

Most firms today understand the source of their revenues but unfortunately, do not understand the *source of profits*. Often, attempts to measure profitability center on either product costs alone or on profitability at the business unit or enterprise level. These attempts can be severely misleading. What firms fail to do is measure profit at the most meaningful and controllable level, the *customer level*. Understanding the underlying components of cost and addressing specific causes of poor profitability associated with specific customers will significantly improve bottom-line performance.

Undertaking a customer account profitability improvement initiative is a **five-step process**:



Customer Profitability Analysis is best conducted with a technique known as Activity Based Costing or ABC analysis. The net profit coming from each customer which can be calculated by revenue *less* costs done by this tool. These costs are not only manufacturing and distribution costs but also sales costs, marketing costs, services cost and any other related costs which have to be undertaken to *service the customer*.



After finalisation of cost customers are divided into different profit tiers. This principle is best observed in the **banking industry** with credit card as a product. Customers are basically classified into four types

- Platinum Customers – Most Profitable
- Gold Customers – Profitable
- Iron Customers – Low Profit but Desirable
- Lead Customers – Unprofitable and Undesirable

A credit card company would always give the best service as well financial and other benefits to the top two customers. It will at the same time try to attract iron customers and try to convert these iron customers to platinum or gold customers. Finally, these companies will have systems in place so as to avoid lead customers completely.

It is found that with customer profitability analysis, the firm can correctly classify customers and also find out which of the customers it needs to hold on to and acquire more of the same type, and which customers it needs to let go of. Several times, firms find out that there are customers which they should have left altogether as the profitability from these customers is minimum and expenses are more.

Cost calculation is one of the major problem in CPA. Calculating cost per customer becomes difficult especially in a service environment where manpower as well as time also has a cost factor associated with it. Time spent with each customer is different and therefore the cost is different. Furthermore, there are several non-customer related costs too. If these costs are ignored, then right figures would be difficult to check. The customers will be shown more profitable than they are.

Customers Lifetime Value (CLV)

Customer Life time value is the present value of net profit that we derive from a customer over the entire lifetime of relationship with that particular customer. It is the *net present value of the projected future cash flows from a lifetime of customer relationship*. It is an essential tool used in marketing to focus on more profitable customers and stop servicing non-profitable customers.

First of all, we need to ascertain the profits generated from each customer. ABC model helps in associating direct costs and revenues to a particular customer over a period of time to ascertain the profit margins from that particular customer. To ascertain the lifetime value, judgements with regards to the *duration of relationships* have to be made. These require detailed analysis of the strength of relationships, the likelihood, frequency and amount of repeated or additional purchases, competitive products, customer loyalty etc. Thus, profit margins are then discounted at the firm's cost of capital or any other rate that may be determined by the organisation to arrive at the CLV.

Illustration

Cineworld is a movie theater is located in a town with many colleges and universities around it. The town has a substantial student population, most of whom are avid movie goers. Business for Cineworld has been slow in the recent years due to the advent of streaming websites, that show the latest and popular movies online. However, the management of Cineworld continue to feel students would still enjoy the watching movies on big-screen, along with the facilities and ambience that only a movie theater can offer. Accordingly, they have framed a plan to attract students by offering discounts on movie tickets.

The average time a student spends at the college or university is 4 years, which is the average duration of any course. For a nominal one-time subscription fee, Cineworld plans to offer students discounts on movie tickets for a period of 4 years. By attracting more footfalls, Cineworld targets to cross sell it food & beverages and souvenirs. This would help it sustain a reasonable revenue each year.

Cineworld would attract attention to the plan by initially offering free tickets, food and beverage and gift vouchers. This one time initial expense, net of the one-time subscription fee collected, would cost ₹5,000 per student. On subscription to the plan, the viewership and purchases of each student is expected to be as follows:

Particulars	Years 1 and 2	Years 3 and 4
Spend on movie tickets per year	2,000	1,500
Spend on food and beverage per year	4,000	3,000
Spend on souvenirs and accessories per year	2,250	750

Assumptions

1. Only 50% of the subscribers are expected to visit the theatres in years 3 and 4.

2. Across all years, only 75% of the subscribers who visit the theatre are expected to buy food and beverage.
3. Only 25% of the subscribers who visit are expected to buy souvenirs in years 1 and 2, and 10% of them in years 3 and 4.

Given that PVIFA of ₹1 for 4 years at 10% = 3.169 and PVIFA of ₹1 for 2 years at 10% = 1.735.

Required

CALCULATE the customer lifetime value per subscriber for the above plan.

Solution

Customer lifetime value per subscriber can be found by calculating the present value of the revenue that is generated over the period of 4 years. This netted out with the cost incurred to attract subscribers, would give the customer lifetime value per subscriber.

Sr. No.	Particulars	Revenue (per year)	PVIFA	PV of Revenue	Probability of Usage	Net Revenue
1	Net cost of attracting students (onetime expense)					5,000
2	Net revenue from movie tickets					
	Years 1-2	2,000	1.735	3,470	100%	3,470
	Years 3-4 (refer note 1)	1,500	1.434	2,151	50%	1,076
3	Sale of food and beverages					
	Years 1-2	4,000	1.735	6,940	75%	5,205
	Years 3-4 (refer note 2)	3,000	1.434	4,302	37.5%	1,613
4	Sale of souvenirs and accessories					
	Years 1-2	2,250	1.735	3,904	25%	976
	Years (refer note 3)	750	1.434	1,076	5%	54
5	Total revenue (Steps 2+3+4)					12,394
6	Net revenue from subscription plan (steps 5-1)					7,394

Note 1:

PVIFA (10%, 4 years) = 3.169 and PVIFA (10%, 2 years) is 1.735. Therefore, PVIF for years 3 and 4 = PVIFA (10%, 4 years) - PVIFA (10%, 2 years) = 3.169 - 1.735 = 1.434.

Note 2:

Only 50% of the subscribers are expected to attend in years 3 and 4. Out of those only 75% are expected to buy food and beverage. Therefore, only 38% of the subscribers (75% of 50% subscribers who visit) are expected to buy souvenirs in years 3 and 4.

Note 3:

Only 50% of the subscribers are expected to attend in years 3 and 4. Out of those only 10% are expected to buy souvenirs. Therefore, only 5% of the subscribers (10% of 50% subscribers who visit) are expected to buy souvenirs in years 3 and 4

Present value of total revenue generated over the four-year period by a customer is ₹12,393 while the corresponding expense is ₹5,000. Therefore, the customer lifetime value per subscriber is ₹7,393. Cineworld has to multiply this with the expected number of subscribers each year, to find out if this would be a profitable proposition.

Customer's Selection, Acquisition, Retention and Extension

Customer **Selection** – Type of customer which the company needs to target has to be selected .

- Who are we targeting?
- What is their value?
- Where do we reach them?

Customer **Acquisition** – A relationship needs *to be developed* with in new customers.

- Methods of acquiring customers include traditional off-line techniques (e.g. advertising, direct mail, etc.) and online techniques (e.g. search engine marketing, online PR, online partnerships, interactive adverts, opt-in e-mail, viral marketing, etc.).

Customer **Retention** - Keeping existing customers.

- Emphasis on understanding customer needs to ensure better customer satisfaction.
- Ensure ongoing service quality by focussing on tangibles, reliability, responsiveness, assurance and empathy.
- E-techniques for retaining customers are personalisation, mass customisation, extranets, opt-in e-mail and online communities.

Customer **Extension** - The products bought by the customers need to be increased.

- "Re-sell" similar products to previous sales
- "Cross-sell" closely related products
- "Up-sell" more expensive products

The use of Information Technology in Downstream Supply Chain Management

In managing downstream supply chain organizations link *their sales system* to the *purchasing system of its customer* through Electronic Data Change. Using E-Business, they sale products.

Intelligence gathering is used to monitor the online customer transactions. E-mail is the way through which organization keeps touch with customers. Use of IT results in quick action, reduction in associated cost and saving in time.

Brand Strategy

Specially branding of product makes a huge difference in its *appeal to customers*. Branding can be usage of logo or specific colour or any other means which makes the product or service distinctively visible among others.

More Information on Key Business Processes

Procurement Process

To enable the flow of manufacturing management process and development of new products, organisation have to make *strategic plans along with its suppliers*. In Global firms, sourcing may be managed on a global basis. The desired outcome is a relationship where both parties benefit and a *reduction in the time* required for the product's design and development.

Development of rapid communication systems, such as Electronic Data Interchange (EDI) and Internet Linkage, to *convey possible requirements faster* may be developed by purchasing departments.

To obtain products and materials from outside suppliers, various activities involving resource planning, supply sourcing, negotiation, order placement, inbound transportation, storage, handling, and quality assurance, etc. have to be done many of which include the *responsibility to coordinate with suppliers* on matters of scheduling, supply continuity (inventory), hedging, and research into new sources or programs. In the recent times, Procurement has become a core source of derive value.

Manufacturing Flow Management Process

Based on the past trends the manufacturing process produces and supplies products to the distribution channels. Flexibility in Manufacturing processes in order to respond to market changes is a must. Orders are processes operating on a just-in-time (JIT) basis in minimum lot sizes. Thus, shorter cycle times, would mean improved responsiveness and efficiency in meeting customer demand. This process manages activities related to planning, scheduling, and supporting manufacturing operations, such as work-in-process storage, handling, transportation, and time phasing of components, inventory at manufacturing sites, etc.

Product Development and Commercialization

Here, customers and suppliers must be integrated into the product development process in order to reduce the time to market.

For the firms to have a competitive edge, as product life cycles get shorter, the appropriate products and services should be developed and successfully launched at even shorter time schedules.

According to Lambert and Cooper (2000), managers of the product development and commercialization process must:

1. Closely coordinate with customer relationship management so that they are able to identify customer-articulated needs;
2. select materials and suppliers in aggregate with procurement; and
3. Enhance production technology in the manufacturing flow to manufacture and integrate into the best supply chain flow for the given combination of product and markets.

Mixing the suppliers for the new product development process was shown to have a major impact on product target cost, quality, delivery, and market share. Tapping into suppliers as a source of innovation requires an extensive process characterized by development of technology sharing, but also involves managing intellectual property issues.

Physical Distribution

This concerns the movement of a finished product or service to customers. In physical distribution, the customer is the final destination of a marketing channel, and the *availability of the product or service is a vital part* of each channel participant's marketing effort. It is also through the physical distribution process that the *time and space of customer service* become an integral part of marketing. Thus, it links a marketing channel with its customers (i.e., it links manufacturers, wholesalers, and retailers).

Service Level Agreements (SLA)

An agreement between the customer and service provider is termed as a service-level agreement. This can be a legally binding formal or an informal "contract". The agreement may be between separate organisation or within different teams of the organisation. SLAs commonly include many components, from a definition of services to the termination of agreement. To ensure that SLAs are consistently met, agreements are often designed with specific lines of differentiation and the parties involved are required to meet regularly to create an open forum for communication. Providers rewards and penalties are specified. There is always place left for revisiting in most SLA.

Benefits of Supply Chain

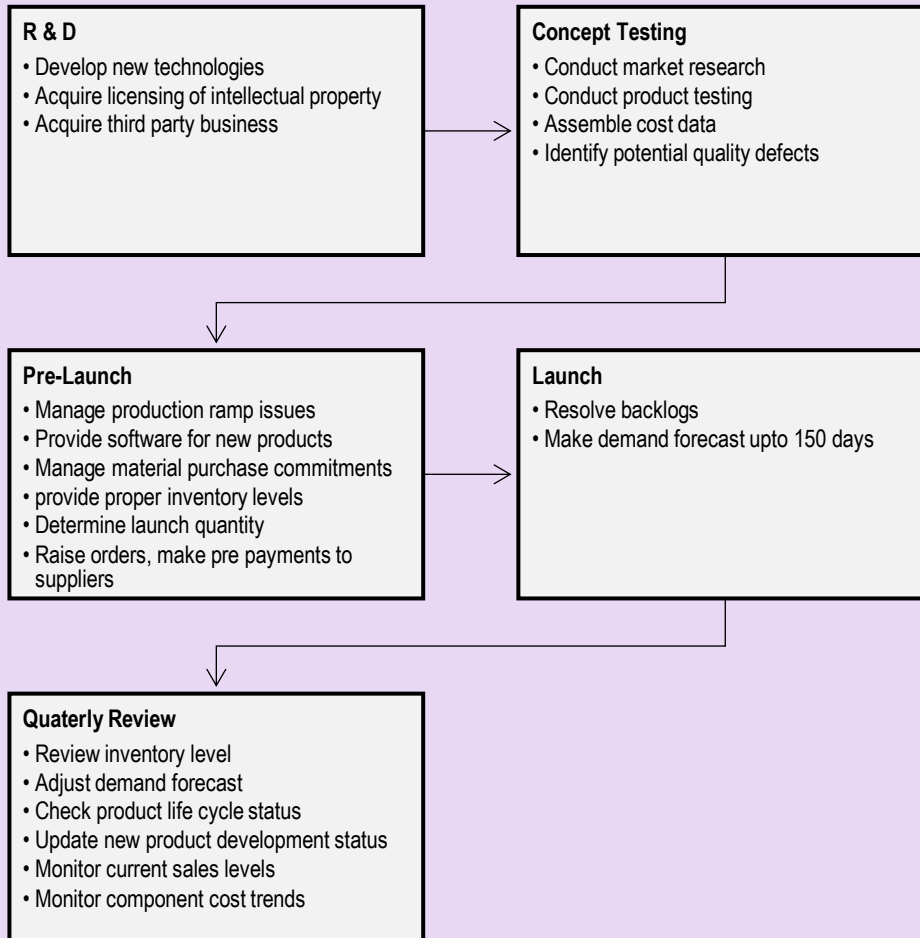
Benefits of supply chain are enormous on any business. Highly controlled supply chain fetches tangible benefits such as inventory reduction, personnel reduction, productivity improvement; order management improvement, financial cycle improvement etc. Further it results in information visibility, new/ improved processes, customer responsiveness, standardization- flexibility & globalization of business performance.

Supply Chain Management in Practice

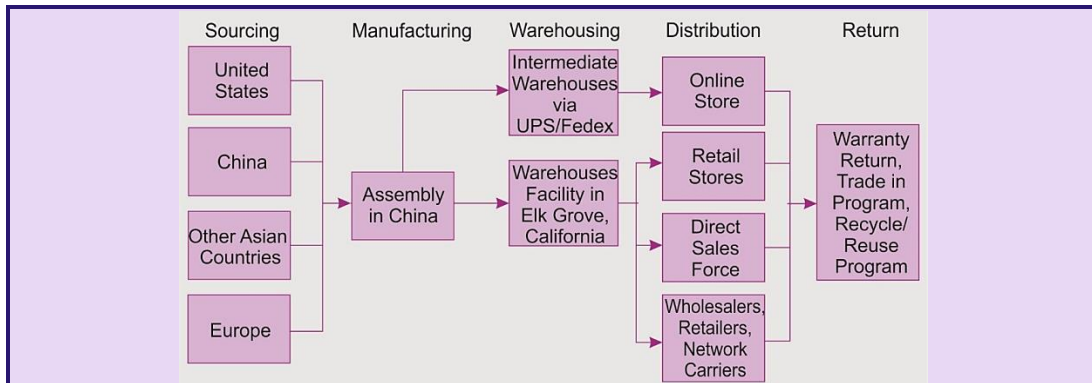
Apple's Supply Chain Model⁵

Supply Chain Planning at Apple Inc is the classic example of New Product Development Process. It's the integration of R&D, Marketing and various function under supply chain

management. Apple Inc accelerates the new product introduction by acquiring the licensing and 3rd party businesses. Apple Inc has to make the pre-payments to some suppliers to secure the strategic raw materials.



Apple Inc purchases raw materials from various sources then get them shipped to an assembling plant in China. From there, assembler will ship products directly to consumers (via UPS/ Fedex) for those who buy from the Apple's Online Store. For other distribution channels, such as retail stores, direct sales and other distributors, Apple Inc will keep products at Elk Grove, California (where central warehouse and call center are located) and supply products from there. At the end of product's life, customer can send products back to the nearest Apple Stores or dedicated recycling facilities.



Apple Supply Chain has very high risks as enumerated below:

- Some re-sellers may also distribute products from the competing manufacturers.
- Inventories can become obsolete or exceed the anticipated demand.
- Some components are currently obtained from the single or limited sources.
- Some custom components are not common to the rest of the industries.
- Ability to obtain components in sufficient quantities is important.

Apple being a marketing company now-a-days having inventory turnover ratio [cost of goods sold of digital content/ downloadable products are excluded] of 59 which is quite impressive. Apple have about 156 key vendors across the globe. In effective supply chain management Apple synchronizes data between the central warehouse in California and its own 246 stores + customers. The success of its supply chain operations depends on how well they manage the **supplier relationship**. This includes early supplier involvement in new product development, close communication, and supplier performance improvement/evaluation.

Supply Chain Collaboration Between Wal-Mart and Procter & Gamble

Before Wal-Mart and Procter & Gamble started collaborating back in the '80s, retailers shared very little information with manufacturers. But then the two giants built a software system that hooked P&G up to Wal-Mart's distribution centers. When P&G's products run low at the distribution centers, the system sends an automatic alert to P&G to ship more. In some cases, the system communicates down to the individual Wal-Mart store, allowing P&G monitor the shelves through real-time satellite link-ups that send messages to the factory whenever a P&G item swoops past a scanner at the register. Within the last couple of years, the relationship has expanded to include radio-frequency identification (RFID) technologies to gain even more insight into ridding inefficiencies in the supply chain.

With this kind of minute-to-minute information, P&G knows when to make, ship and display more products at the Wal-Mart stores. There's no need to keep products piled up in warehouses awaiting Wal-Mart's call. Invoicing and payments happen automatically too. The system saves P&G so much in time, reduced inventory and lower order-processing costs that it can afford to give Wal-Mart "low, everyday prices" without putting itself out of business.

(5. Source: Supply Chain Management, Apple Inc., <http://www.supplychainopz.com>)



GAIN SHARING ARRANGEMENTS⁶

Gain sharing is an approach to the review and adjustment of an existing contract, or series of contracts, where the adjustment provides benefits to both parties. A fundamental form of gain-sharing is where a supplier agrees to perform its side of the contract with no guarantee of receiving a payment. Instead, any payment received is based upon the benefits that emerge to the customer as a result of the successful completion of the supplier's side of the bargain. This is clearly a risky stance for the supplier, because it could spend a fortune and walk away with nothing. Alternatively, if the benefits to the customer are substantial, the supplier could find itself rewarded with a large return. In this situation, the supplier could almost be described as taking an equity stake in the customer rather than entering into a contract with it. There must be no rewards for the suppliers to achieve a higher return through adversarial behaviour or by hiding behind the contract. Gain-sharing deals are, on the face of it, a win-win situation for suppliers and their customers.

Example

Cost Savings initiatives and Gain Sharing arrangements at Chiang International-

- Supplier will deliver 3% minimum cost savings on *controllable portion* of costs.
- Cost savings generated in first year as a result of Supplier idea will be retained by Supplier.
- Cost savings generated in year second will be shared between Chiang International and Supplier at a ratio of 40%:60%.
- Cost savings generated in year three will be passed along to Chiang International.
- Any cost savings generated by an idea proposed exclusively by Chiang International that does not require capital investment by Supplier will be immediately passed along to Chiang International.

(6. Source: Article on 'Management Accounting – Decision Management' by Tim Thompson; Other References- R Source Strategic Management of Universities in the Ibero-America Region: A edited by Jairo H. Cifuentes-Madrid, Pablo Landoni Couture, Xavier Llinàs Audet)



OUTSOURCING

Outsourcing (also sometimes referred to as "contracting out") is a business practice used by companies to reduce costs or improve efficiency by shifting tasks, operations, jobs or processes to another party for a span of time.

The contract given to third party can be done at the premises or outside. Outsourcing is a cost-saving measure, and practising this can have a significant impact on manufacturing.

Outsourcing is not limited to manufacturing. Giving services to customer such as those in a call center, and computer programming jobs are also outsourced by companies seeking ways to reduce costs.

A part of product may even be purchased from outside this would be within the purview of outsourcing, such as components for computer equipment. The component can be purchased for a lower cost than it would be for the company to manufacture that component themselves, and the component may be of higher quality. Outsourcing is often an integral part of downsizing or reengineering.

Advantages of Outsourcing

- Outsourcing helps in cost savings. The lower cost of operation and labour, and Reduction in overhead costs makes it attractive to outsource.
- It frees an organization from investments in technology, infrastructure and people that make up the bulk of a back-end process capital expenditure.
- It gives businesses flexibility in staffing, manpower management, helps in cost savings.

Disadvantages of Outsourcing

- One of the biggest disadvantages is the risk of losing sensitive data and the loss of confidentiality.
- Control of operations and deliverables of activities outsourced.
- Inexperienced worker or improper process can lead to quality problems.

Outsourcing in Practice

Parexel

The Challenge

Parexel needed a recruitment solution that would not only source and screen potential candidates, but also develop and build talent pipelines, understand the labor market, deliver top candidates during periods of heavy hiring, scale up and down quickly, and build a strong connection between the hiring manager and recruiting consultants.

The solution

Parexel selected 'IBM Talent Acquisition & Optimization' and 'IBM Kenexa Brass Ring on Cloud' to attract top talent and meet its organizational hiring needs.

The benefits

- Hired at 90 percent over forecast in the program's first year.
- Delivered a multi-regional solution, including North America and 17 countries in Europe.
- Lowered time-to-fill by 40 percent.



SUMMARY

- Cost of Quality – It is the sum of the costs related to prevention and detection of defects and the costs incurred due to occurrences of defects. Cost of quality consists of the Prevention Cost, Appraisal Cost, Internal Failure Cost and External Failure Cost.
- Total Quality Management – TQM aims at improving the quality of organizations outputs, including goods and services, through continual improvement of internal practices.
The plan – do – check – act (PDCA) cycle describes the activities a company needs to perform in order to incorporate continuous improvement in its operation.
6Cs' - Commitment, Culture, Continuous Improvement, Co-operation, Customer Requirements and Control.
- Business Excellence Model – The EFQM Excellence Model provides an all-round view of the organisation and it can be used to determine how these different methods fit together and complement each other. Based on the needs of the organisation, this model can be used with other tools of improvement to attain sustainable excellence.
- Theory of Constraints – The theory of constraints focuses on revenue and cost management when faced with bottlenecks. It advocates the use of three key measures – Throughput, Investments and Operating expenses. The objectives of management can be expressed as increasing throughput, minimizing investment and decreasing operating expenses.
 - (a) $\text{Throughput} = (\text{Sales Revenue} - \text{Unit Level Variable Expenses}) / \text{Time}$
 - (b) Investment is money associated with turning materials into Throughput and do not have to be immediately expensed.
 - (c) Operating expense is the money spent in turning Investment into Throughput and therefore, represents all other money that an organisation spends.
 - (d) Five step method of improving performance – Identify System Bottlenecks, Exploit the Constraint, Subordinate and Synchronise to the Constraint, Increase Bottleneck efficiency and Capacity, Repeat the process as and when a new constraint arises.
- $\text{Throughput Accounting Ratio} = \frac{\text{Throughput per bottleneck minute}}{\text{Factory cost per bottleneck minute}}$
- Supply Chain Management – The term supply chain can be referred to as the entire network of organisations working together to design, produce, deliver and service products.
 - (a) Types of Supply Chain based on forecasted demand and actual demand are push and pull supply chain
 - (b) Key to Supply Chain Processes –
 - Customer Relationship Management – Understanding customer needs and providing them with the best possible solution to assist in customer retention and driving sales growth.

- Customer Service Management – Better customer service gives higher customer retention. Customer Service is the source of customer information.
 - Demand Management Style – Flexibility in manufacturing process to react to changing market is a must. Orders processed under JIT with minimum lot sizes have shorter cycle time and thus increases efficiency in meeting customer demands.
 - Order Fulfilment – Timely fulfilment of customer demands.
 - Manufacturing Flow Management – This process manages activities related to planning, scheduling, and supporting manufacturing operations, such as work-in-process storage, handling, transportation, and time phasing of components, inventory at manufacturing sites, etc.
 - Supplier Relationship Management – When selecting the key suppliers, weightage should be given to Supplier capabilities of innovation, quality, reliability and costs/price reductions and agility to reduce risk factors
 - Product Development and Commercialization – Customers and suppliers must be integrated into the product development process in order to reduce the time to market. For the firms to have a competitive edge, as product life cycles get shorter, the appropriate products and services should be developed and successfully launched at even shorter time schedules.
 - Returns Management – Returns management is necessary in case of both upstream and downstream supply chain flow for optimum utilisation of resources and reduction in cost of repairs and renewal.
 - Customer Account Profitability – Profitability associated with each customer. What companies fail to do is measure profit at the most meaningful and controllable level, the customer level. Understanding the underlying components of cost and addressing specific causes of poor profitability will significantly improve bottom-line performance.
 - Customer Life Time Value - It is the net present value of the projected future cash flows from a lifetime of customer relationship.
- (c) Benefits of Supply Chain Management - Tangible benefits such as inventory reduction, personnel reduction, productivity improvement; order management improvement, financial cycle improvement etc. Further it results in information visibility, new/ improved processes, customer responsiveness, standardization-flexibility & globalization of business performance.
- Gain Sharing Arrangements – Gain sharing is an approach to the review and adjustment of an existing contract, or series of contracts, where the adjustment provides benefits to both parties.
 - Outsourcing – Outsourcing (also sometimes referred to as "contracting out") is a business practice used by companies to reduce costs or improve efficiency by shifting tasks, operations, jobs or processes to another party for a span of time.



TEST YOUR KNOWLEDGE

Cost of Quality/ Total Quality Management

1. CIMZ is a new banking company which is about to open its first branch in INDIA. CIMZ believes that in order to win customers from the market, it needs to offer potential customers a new banking experience. Other banking companies are focusing on interest rates and bank charges, whereas CIMZ believes that quality and timely availability of service is an important factor to attract customers.

Required

EXPLAIN how Total Quality Management would enable CIMZ to gain competitive advantage in the banking sector.

2. Cool Air Private Ltd. manufactures electronic components for cars. Car manufacturers are the primary customers of these products. Raw material components are bought, assembled and the electronic car components are sold to the customers.

The market demand for these components is 500,000 units per annum. Cool Air has a market share of 100,000 units per annum (20% market share) for its products. Below are some of the details relating to the product:

Selling price	₹2,500 per unit
Raw material cost	₹900 per unit
Assembly & machine cost	₹500 per unit
Delivery cost	₹100 per unit
Contribution	₹1,000 per unit

The customers due to defects in the product return 5,000 units each year. They are replaced free of charge by Cool Air. The replaced components cannot be repaired and do not have any scrap value. If these defective components had not been supplied, that is had the sale returns due to defective units been nil, customers' perception about the quality of the product would improve. This could yield 10% increase in market share for Cool Air, that is demand for its products could increase to 150,000 units per annum.

Required

- (i) ANALYZE, the cost of poor quality per annum due to supply of defective items to the customers.
- (ii) The company management is considering a proposal to implement an inspection process immediately before delivery of products to the customers. This would ensure nil

sales returns. The cost of having such a facility would be ₹2 crores per annum, this would include materials and equipment for quality check, overheads and utilities, salaries to quality control inspectors etc. ANALYZE the net benefit, if any, to the company if it implements this proposal.

- (iii) Quality control investigations reveal that defective production is entirely on account of inferior quality raw material components procured from a large base of 30 suppliers. Currently there is no inspection at the procurement stage to check the quality of these materials. The management has a proposal to have inspectors check the quality control at the procurement stage itself. Any defective raw material component will be replaced free of cost by the supplier. This will ensure that no product produced by Cool Air is defective. The cost of inspection for quality control (materials, equipment, salaries of inspectors etc.) would be ₹4 crores per annum. ANALYZE the net benefit to the company if it implements this proposal? Please note that scenarios in questions (ii) and (iii) are independent and not related to each other.
 - (iv) Between inspection at the end of the process and inspection at the raw material procurement stage, ADVISE a better proposal to implement (a) in terms of profitability and (b) in terms of long term business strategy?
3. EKS Ltd. manufactures a single product, which requires three components. The company purchases one of the components from three suppliers. DE Ltd., PE Ltd. and ZE Ltd. The following information are available:

	DE Ltd.	PE Ltd.	ZE Ltd.
Price quoted by supplier (per hundred units)	₹240	₹234	₹260
% of Defective of total receipts	3%	5%	2%

If the defectives are not detected they are utilized in production causing a damage of ₹200 per 100 units of the component. Total requirements are 12,000 units of the components.

The company intends to introduce a system of inspection for the components on receipt. The inspection cost is estimated at ₹26 per 100 units of the components. Such as inspection will be able to detect only 90% of the defective components received. No payment will be made for components found to be defective in inspection.

Required

- (i) Advice whether inspection at the point of receipt is justified.
 - (ii) Which of the three suppliers should be asked to supply?
4. A company produces and sells a single product. The cost data per unit for the year 2019 is predicted as below:

	₹ per unit
Direct Material	35
Direct Labour	25

Variable Overheads	15
Selling Price	90

The company has forecast that demand for the product during the year 2019 will be 28,000 units. However, to satisfy this level of demand, production quantity will be increased?

There are no opening stock and closing stock of the product.

The stock level of material remains unchanged throughout the period.

The following additional information regarding costs and revenue are given:

- 12.5% of the items delivered to customers will be rejected due to specification failure and will require free replacement. The cost of delivering the replacement item is ₹5 per unit.
- 20% of the items produced will be discovered faulty at the inspection stage before they are delivered to customers.
- 10% of the direct material will be scrapped due to damage while in storage.

Due to above, total quality costs for the year is expected to be ₹10,75,556.

The company is now considering the following proposal:

1. To introduce training programmes for the workers which, the management of the company believes, will reduce the level of faulty production to 10%. This training programme will cost ₹4,50,000 per annum.
2. To avail the services of quality control consultant at an annual charges of ₹50,000 which would reduce the percentage of faulty items delivered to customers to 9.5%.

Required

- (i) PREPARE a statement of expected quality costs the company would incur if it accepts the proposal. Costs are to be calculated using the four recognised quality costs heads.
- (ii) Would you RECOMMEND the proposal? Give financial and non-financial reasons.

Theory of Constraints

5. Z Plus Security (ZPS) manufactures surveillance camera equipment that are sold to various office establishments. The firm also installs the equipment at the client's place to ensure that it works properly. Each camera is sold for ₹2,500. Direct material cost of ₹1,000 for each camera is the only variable cost. All other costs are fixed. Below is the information for manufacturing and installation of this equipment:

Particulars	Manufacture	Installation
Annual Capacity (camera units)	750	500
Actual Yearly Production and Installation (camera units)	500	500

Required

The questions below are separate scenarios and are not related to each other.

- (i) IDENTIFY the bottleneck in the operation cycle that ZPS should focus on improving. Give reasoning for your answer.
- (ii) An improvement in the installation technique could increase the number of installations to 550 camera units. This would involve total additional expenditure of ₹40,000. ADVISE ZPS whether they should implement this technique?
- (iii) Engineers have identified ways to improve manufacturing technique that would increase production by 150 camera units. This would involve a cost ₹100 per camera unit due to necessary changes to be made in direct materials. ADVISE ZPS whether they should implement this new technique.

**ANSWERS/ SOLUTIONS**

1. Total Quality Management is a management philosophy. It concerns itself with managing the processes and people to make sure that the customer is satisfied at each and every stage. This means *making the needs of the customer the priority, expanding the relationship beyond traditional services and incorporating the customer's needs in the company's business plan and corporate strategy*. In TQM, the concept of "quality" is perceived exclusively from the frame of reference of the customer. These customers can be internal, such as, those working in another department and there can be external customers who are the end recipients of the product or services. The organisation should attempt for continuous improvement in the quality that it delivers with the ultimate aim of achieving zero defects in this quality.

TQM should be viewed as an investment rather than as a cost that should be minimised. There are many ways in which investment can be made in TQM.:

- fine-tuning the product mix,
- fine-tuning of the processes of ensuring quality,
- introducing employee development programmes with the nature of an academic course,
- empowering the employees professionally and personally,
- improving the top management commitment to quality,
- monitoring of the performances and proper rewarding based on achievements,
- ensuring the customer satisfaction etc.

CIMZ could provide its employees with *training* in the technical aspects of banking practice as well as in customer care. Customers would thus get a better service not only technically but also from a customer care perspective. This should lead to smaller customer complaints and greater customer satisfaction. It could also motivate customers to recommend others to use this bank.

TQM also requires CIMZ to respond to its customer's requirements immediately for example by providing more staff to reduce the lengths of queues in festive/ seasonal/ busy time. If Bank could also be opened for longer hours to allow customers to complete their bank related requirements and have meetings with bank employees at a time that is more convenient for the customer, this would lead to more satisfaction to customers.

In long run, if bank continue to follow TQM, the bank would have higher profits and competitive advantage in banking sector despite incurring additional expenditure to improve quality.

2. (i) Customer demand for Cool Air's products is 100,000 units per annum. However, 5,000 defective units supplied are to be replaced free of charge by the company. Therefore, the total number of items supplied to customers per annum = 100,000 + 5,000 units = 105,000 units. The cost of replacement would include raw material cost, assembly & machining cost and delivery cost of 5,000 units = 5,000 units × (900+500+100) per unit = 5,000 units × ₹1,500 per unit = ₹75,00,000 per annum. Further, had the sale returns not happened, market share would have increased by 50,000 units. Contribution is ₹1,000 per unit, for 50,000 units contribution would be ₹5,00,00,000. Therefore, the cost of poor quality per annum = cost of replacement + contribution from lost sales = ₹75,00,000 + ₹5,00,00,000 = ₹5,75,00,000 per annum.
- (ii) Inspection at the end of the process would detect defects before delivery to the customers. This would ensure that the sale returns would be nil. Given in the problem, 5,000 units supplied are defective and would need to be replaced, in other words, they need to be manufactured again. In other words, inspection after production, before delivery to customers would not prevent production of defective units. However, compared to the current scenario, since these defective units have not yet been delivered to the customer, the cost for additional delivery of replaced products would be saved. This savings in the extra delivery cost = 5,000 units × ₹100 per unit = ₹5,00,000 per annum. Further, had the sale returns not happened, market share would have increased by 50,000 units. Contribution is ₹1,000 per unit, for 50,000 units it would be ₹5,00,00,000 per annum. Therefore, the total benefit from the inspection process before delivery to customers = savings on delivery costs + contribution from incremental sales = ₹5,00,000 + ₹5,00,00,000 = ₹5,05,00,000 per annum. The cost to the company to maintain good quality of its products through inspection = ₹2,00,00,000 per annum. Therefore, the net benefit to the company would be ₹3,05,00,000.
- (iii) Inspection of raw material at the procurement stage could entirely eliminate defective production. The benefit would be two-fold, the current replacement cost for 5,000 units will no longer be incurred. Secondly, due to better customer perception, market share would increase, resulting in an increased contribution / revenue to the company. In other words, the cost of poor quality will be nil.

As explained in solution (i), the cost of poor quality per annum = cost of replacement + contribution from lost sales = ₹75,00,000 + ₹5,00,00,000 = ₹5,75,00,000 per annum. This would be the benefit by implementing the proposal.

Cool Air has to incur an inspection cost to ensure this highest standard of quality (0% defects) which would cost ₹4,00,00,000 per annum. Therefore, the net benefit to the company would be ₹1,75,00,000 per annum.

- (iv) (a) The proposal to implement inspection immediately before delivering goods to the customers results in a net benefit of ₹3,05,00,000 per annum. Alternately, the proposal to implement inspection at the raw material procurement stage results in a net benefit of ₹1,75,00,000 per annum. Therefore, from a profitability point of view, inspection immediately before delivery of goods to the customer would be the preferred option.
- (b) The drawback of inspection at the end of the production process is that (1) it cannot prevent production of defective goods and (2) information regarding the root cause of defective production, in this case, supply of defective raw materials will not get tracked. Therefore, inspection at the end of production does not contribute to resolving the root cause of defective production. On the other hand, inspection at the procurement stage can eliminate production of defective goods. This will ensure a much higher quality of production, better utilization of resources and production capacity. Therefore, from a long-term strategy point of view, inspection at the raw material procurement stage will be very beneficial. Currently the cost of ensuring this highest quality of production (0% defects) is ₹4 crores per annum. The cost of ensuring 100% quality is quite high, such that the net benefit to the company is lesser than the other proposal. However, due to its long-term benefit, Cool Air may consider some minimum essential quality control checks at the procurement stage. Although selective quality check might not ensure complete elimination of defective production, it can contribute towards reducing it. At the same time cost of selective quality check would not be so high as to override its benefits. To determine the extent of quality control inspection, Cool Air should determine its tolerance limit for defective production and do an analysis of the quality / cost trade-off.

3. (i) **A: Statement Showing Computation of Effective Cost before Inspection**

Particulars	DE Ltd.	PE Ltd.	ZE Ltd.
Units Supplies (No.s)	12,000	12,000	12,000
Defectives Expected (No.s)	360	600	240
Costs:			
Purchase of Components	28,800	28,080	31,200
Add: Production Damage on Defective Components (@ ₹200 per 100 components)	720	1,200	480

Total	29,520	29,280	31,680
Good Components (Nos.)	11,640	11,400	11,760
Cost per 100 Good Components	253.61	256.84	269.39

B: Statement Showing Computation of Effective Cost after Inspection

Particulars	DE Ltd.	PE Ltd.	ZE Ltd.
Units Supplies (No.s)	12,000	12,000	12,000
Defects Not Expected (No.s)	36	60	24
Defectives Expected (No.s)	324	540	216
Components Paid For	11,676	11,460	11,784
Costs:			
Purchase of Components	28,022.40	26,816.40	30,638.40
Add: Inspection Cost	3,120.00	3,120.00	3,120.00
Add: Production Damage on Defective Components (@ ₹200 per 100 components)	72.00	120.00	48.00
Total	31,214.40	30,056.40	33,806.40
Good Components (Nos.)	11,640	11,400	11,760
Cost per 100 Good Components	268.16	263.65	287.47

Advice Whether Inspection at the Point of Receipt is Justified

On comparing the cost under situation, A and B shown above, we find that it will not be economical to install a system of inspection.

Further we also need to consider that presently many organizations are undergoing Just in Time (JIT) implementation. JIT aims to find a way of working and managing to eliminate wastes in a process. Achievement of this is ensured through eliminating the need to perform incoming inspection. Inspection does not reduce the number of defects, it does not help in improving quality. In general inspection, does not add value to the product. It simply serves as a means of identifying defects the supplier has failed to recognize subsequent to the manufacturing of the product.

As a matter of fact, organizations implementing JIT are seeking eventually to eliminate the need for performing incoming inspection activities through a combination of reducing the supplier base, selection through qualification and vendor development. Vendor development and its proper management seeks to assist the supplier who maintains an interest in striving to provide 100% defect-free materials and parts.

So, to decision whether inspection at the point of receipt is justified or not will also depend on Qualitative factors as well.

- (ii) On comparing the buying cost of components under different situations, as analysed and advised above, if company decides not to install a system of inspection, supplier DE would be cheaper otherwise supplier PE would be cheaper and company may choose supplier accordingly.



This question can also be solved by assuming receipt of **good components** as requirement i.e. 12,000 units.

4. (i) **Statement of 'Expected Quality Costs'**

Particulars	Current Situation (₹)	Proposed Situation (₹)
Prevention Costs	---	4,50,000
Appraisal Costs	---	50,000
External Failure Costs	3,20,000	2,35,120
Internal Failure Costs	7,55,556	3,91,538
Total Quality Costs	10,75,556	11,26,658

Workings

External Failure Cost

Particulars	Current Situation	Proposed Situation
Customer's Demand ... (A)	28,000 units	28,000 units
Number of units Dispatched to Customers ... (B) $\left(\frac{28,000 \text{ units}}{87.5\%} \right); \left(\frac{28,000 \text{ units}}{90.5\%} \right)$	32,000 units	30,939 units
Number of units Replaced ... (B) – (A)	4,000 units	2,939 units
External Failure Cost {4,000 units × ₹(35+25+15+5)}; {2,939 units × ₹(35+25+15+5)}	₹3,20,000	₹2,35,120

Internal Failure Cost

Particulars	Current Situation	Proposed Situation
Number of units Dispatched to Customers ... (A)	32,000 units	30,939 units
Number of units Produced & Rejected ... (B) $\left(\frac{32,000 \text{ units}}{80\%}\right); \left(\frac{30,939 \text{ units}}{90\%}\right)$	40,000 units	34,377 units
Number of units Discovered Faulty ... (B) – (A)	8,000 units	3,438 units
Cost of Faulty Production ... (D) {8,000 units × ₹(35+25+15)}; {3,438 units × ₹(35+25+15)}	₹6,00,000	₹2,57,850
Material Scrapped $\left(\frac{40,000 \text{ units}}{90\%} \times 10\%\right); \left(\frac{34,377 \text{ units}}{90\%} \times 10\%\right)$	4,444.44 units	3,819.67 units
Cost of Material Scrapped ... (E) {4,444.44 units × ₹35}; {3,819.67 units × ₹35}	₹1,55,556	₹1,33,688
Internal Failure Cost ... (D)+(E)	₹7,55,556	₹3,91,538

(ii) Recommendation

On purely *financial grounds* the company should not accept the proposal because there is an increase of ₹51,102 in quality costs. However there may be *other factors* to consider as the company may enhance its reputation as a company that cares about quality products and this may increase the company's market share.

On balance the company should accept the proposal to improve its *long-term* performance.

5. (i) **Identification of Bottleneck:** Installation of cameras is the bottleneck in the operation cycle. The annual capacity for manufacturing and installation are given to be 750 camera units and 500 camera units respectively. Actual capacity utilization is 500 camera units, which is the maximum capacity for the installation process. Although, ZPS can additionally manufacture 250 camera units, it is constrained by the maximum units that can be installed. Therefore, the number of units manufactured is limited to 500 camera units, subordinating to the bottleneck installation operation. Therefore, ZPS should focus on improving the installation process.
- (ii) **Improving Capacity of Installation Technique:** Every camera sold increases the through put contribution by ₹1,500 per camera unit (sale price ₹2,500 per camera unit less direct material cost ₹1,000 per camera unit). By improving the current installation technique an additional 50 camera units can be sold and installed. This would involve total additional expenditure of ₹40,000. Hence, the incremental benefit would be:

Particulars	Amount (₹)
Increase in throughput contribution (additional 50 camera units ₹1,500 per camera unit)	75,000
Less: Increase in total expenditure	40,000
Incremental benefit	35,000

Since the annual incremental benefit is ₹35,000 per annum, ZPS should implement this improvement to installation technique, the current bottleneck operation.

- (iii) **Improving Manufacturing Capacity:** Every camera sold increases the throughput contribution by ₹1,500 per camera unit (sale price ₹2,500 per camera unit less direct material cost ₹1,000 per camera unit). By improving the current manufacturing technique an additional 150 camera units can be produced. This would involve a cost ₹100 per camera unit due to necessary changes to be made in direct materials. Therefore, number of units manufactured can increase to 650 camera units. However, production of 150 camera units will not translate into additional sales, because each sale also requires installation by ZPS. In a year only 500 camera installations can be made, leading to an inventory pile up of 150 camera units. This is detrimental to ZPS, since it does not earn any contribution by holding inventory. Therefore, ZPS should not go ahead with the proposal to improve the manufacturing technique.



LEAN SYSTEM AND INNOVATION



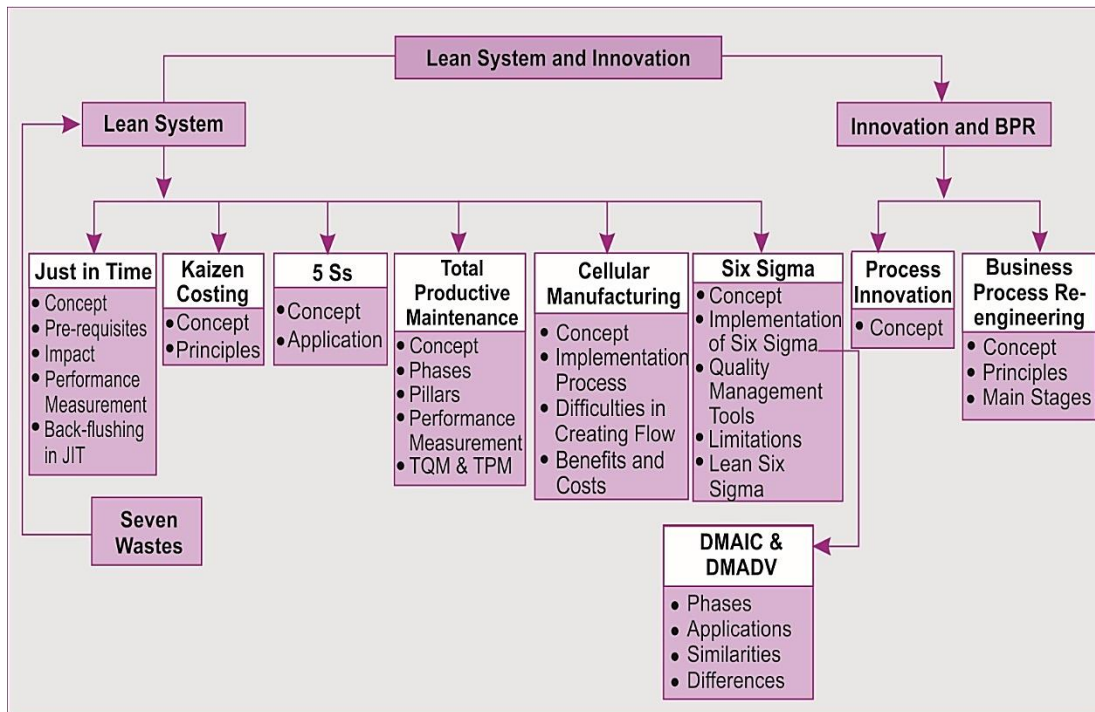
LEARNING OUTCOMES

After studying this chapter, you will be able to:

- ❑ **Explain** the impact of JIT manufacturing methods on cost accounting methods
- ❑ **Discuss** and apply the Kaizen Costing, 5Ss, TPM Six Sigma
- ❑ **Advise** on JIT System, Six Sigma & BPR



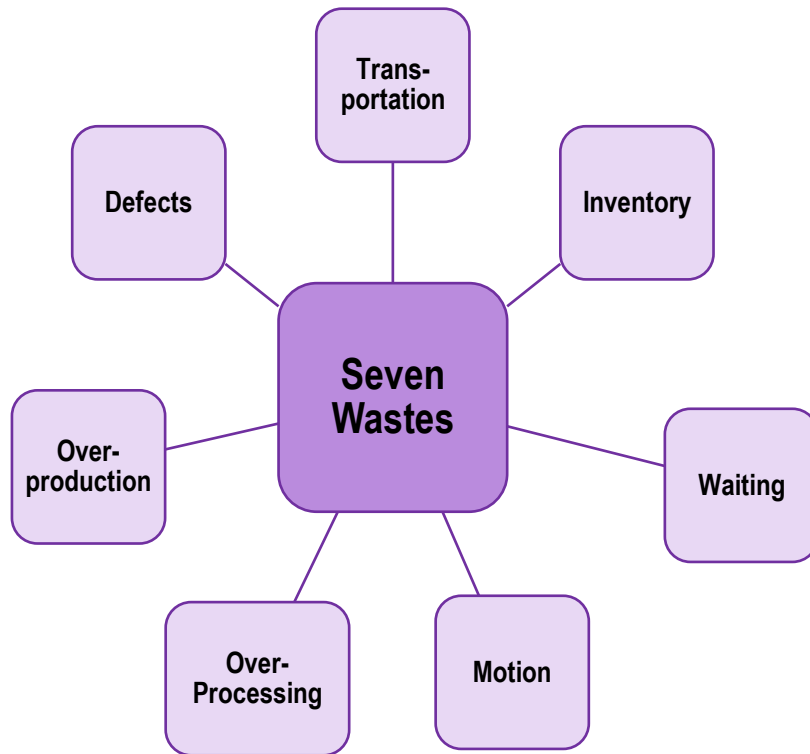
CHAPTER OVERVIEW



LEAN SYSTEM

Lean System is an organized method for waste minimization without sacrificing productivity within a manufacturing system. Lean implementation emphasizes the importance of optimizing work flow through strategic operational procedures while minimizing *waste* and being adaptable.

Waste is any step or action in a process that is not required to complete a process successfully (called “Non-Value Adding”). When Waste is removed, only the steps that are required (called “Value-Adding”) to deliver a satisfactory product or service to the customer remain in the process. There are generally 7 type of wastes:



The **Seven Wastes** expanded are:

Overproduction: Producing ahead of demand.

Inventory: Having more inventory than is minimally required at any point in the process, including end-product.

Waiting: Waiting includes products waiting on the next production step.

Motion: People or equipment moving or walking more than is required to perform the process.

Transportation: Moving products that is not actually required to perform the process.

Rework from defects: Non-right first time.

Over Processing: Unnecessary work elements (non-value added activities).

Many large manufacturing companies like General Motors and Toyota are into lean manufacturing. Lean manufacturing involves a shift in traditional thinking, from batch and queue to product-aligned pull production. Instead of producing a lot of parts, the focus is on different types of operations conducted adjacent to each other in a continuous flow.

Some of the techniques are:

- Just-in-Time (JIT)
- Kaizen Costing

- 5 S
- Total Productive Maintenance (TPM)
- Cellular Manufacturing/ One-Piece Flow Production Systems
- Six Sigma (SS)

Most of these applications are based on following *principles*:

- Perfect first-time quality
- Waste minimization
- Continuous improvement
- Flexibility

The *characteristics* of lean manufacturing:

- Zero waiting time
- Zero inventory
- Pull processing
- Continuous flow of production
- Continuous finding ways of reducing process time.



JUST-IN-TIME (JIT)

A just in time approach is a collection of ideas that streamline a company's production process activities to such an extent that wastage of all kinds viz., of time, material, and labour is systematically driven out of the process. JIT has a decisive, positive impact on product costs.

CIMA defines:

“Just-in-time (JIT): System whose objective is to produce or to procure products or components as they are required by a customer or for use, rather than for stock. *just-in-time system Pull system, which responds to demand, in contrast to a push system, in which stocks act as buffers between the different elements of the system such as purchasing, production and sales”.*

“Just-in-time production: Production system which is driven by demand for finished products, whereby each component on a production line is produced only when needed for the next stage”.

“Just-in-time purchasing: Purchasing system in which material purchases are contracted so that the receipt and usage of material, to the maximum extent possible, coincide”.

A complete JIT system begins with production, includes deliveries to a company's production facilities, continues through the manufacturing plant, and even includes the types of transactions processed by the accounting system.

Spare Parts/ Materials from suppliers on the exact date and at the exact time when they are needed	Straight delivery to the production floor for immediate use in manufactured products	Visit of engineering staff at supplier sites to examine supplier's processes
Installation of EDI system that tells suppliers exactly how much of which parts are to be sent	Dropping off products at the specific machines	Shorten the setup times
Eliminating the need for long production runs/ Streamlined flow of parts from machine to machine	Training to employees how to operate a multitude of different machines, perform limited maintenance	Several alterations in the supporting accounting systems

“Process that vastly reduces the amount of raw materials inventory and improves the quality of received parts”

- To begin with, a company must ensure that *it receives products/spare parts/materials from its suppliers on the exact date and at the exact time when they are needed*. For this reason the purchasing staff must investigate and evaluate every supplier, eliminate those which could not keep up with the delivery dates.
- In addition, *deliveries should be sent straight to the production floor for immediate use in manufactured products*, so that there is no time to inspect incoming parts for defects.
- Instead, *the engineering staff must visit supplier sites and examine their processes*, not only to see if they can reliably ship high-quality parts but also to provide them with engineering assistance to bring them up to a higher standard of product.
- As soon as suppliers certify for their delivery and quality, the concern must *install a system*, which may be as simplistic as a fax machine or as advanced as an *electronic data interchange system* or linked computer systems, that tells suppliers exactly how much of which parts are to be sent to the company.
- Drivers then bring small deliveries of product to the company, possibly going to the extreme of dropping them off at the specific machines that will use them first.

“Process in which a company reduces the amount of work-in-process, while also shrinking the number of products that can be produced before defects are identified and fixed, thereby reducing scrap costs”

- Next, *we shorten the setup times for concern 's machinery*. In most of the factories equipment is changed over to new configurations as rarely as possible because the conversion is both lengthy and expensive. When setups take a long time, company management authorizes long production runs, which spreads the cost of the setup over far more units, thereby reducing the setup cost on a per-unit basis. However, with this approach too many products are frequently made at one time, resulting in product obsolescence, inventory carrying costs, and many defective products (because problems may not be discovered until a large number of items have already been completed). *'But under JIT system a different approach to the setup issue is followed which focuses on making a video tape of a typical set up, instead of reducing the length of equipment setups and thereby eliminating the need for long production runs to reduce per unit costs. A team of industrial engineers and machine users examines this tape, spotting and gradually eliminating steps that contribute to a lengthy setup '.* It is not unusual, after a number of iterations, to achieve setup times of minutes or seconds when the previous setup times were well into hours.
- It is not sufficient to reduce machine setup times because there are still problems with machines not being coordinated properly so that *there is a smooth, streamlined flow of parts from machine to machine*. In most of the companies there is such a large difference between the operating speeds of different machines that work-in-process inventory builds up in front of the slowest ones. Not only does this create an excessive quantity of work-in-process inventory, but defective parts produced by an upstream machine may not be discovered until the next downstream machine operator works his way through a pile of work-in-process and finds them. By the time this happens the upstream machine may have created more defective parts, all of which must now be destroyed or reworked. There are two ways to resolve both problems.

First

The first involves a “**kanban card,**” which is a notification card that a downstream machine sends to each machine that feeds it parts, authorizing the production of just enough components to fulfill the production requirements being authorized in turn by the next machine further downstream. This is also known as a “pull” system, since kanbans are initiated at the *end* of the production process, pulling work authorizations through the production system. With this approach, there is no way for work-in-process inventory to build up in the production system, since it can be created only with a kanban authorization.

Second

The second way to reduce excessive work-in-process inventory and defective parts, is to, **group machines into working cells**. A working cell is a small cluster of machines which can be run by a single machine operator. This individual machine operator takes each output part from machine to machine within the cell; and thus there is no way for work-in-process to build up between machines. Also, this operator can immediately identify defective output which otherwise is difficult for each machine of the cell. This configuration has the additional benefit of lower maintenance costs since the smaller machines used in a machine cell are generally much simpler than the large, automated machinery they replace. Also, because the new machines are so small, it is much easier to reconfigure the production facility when it is necessary to produce different products, avoiding the large expense of carefully repositioning and aligning equipment.

Both kanbans and machine cells should be used together—they are not mutually exclusive. By doing so a company can achieve extremely low product defect rates, as well as vanishingly small investments in work-in-process inventory.

- Before the preceding steps are completed, *it becomes apparent that a major change must also be made in the work force.* The traditional approach is to have one employee maintaining one machine, which is so monotonous that workers quickly lapse into apathy and develop a complete disregard for the quality of their work. Now, with full responsibility for a number of machines, as well as product quality, workers become much more interested in what they are doing. *To enhance this situation the human resource development department of organisation must prepare and organise training classes to teach to employees how to operate a multitude of different machines, perform limited maintenance on the machines without having to call in the maintenance staff, spot product errors, understand how the entire system flows, and when to halt the production process to fix problems.* In short, the workforce must be completely retrained and focused on a wide range of activities. This usually results in a reconfiguration of the compensation system as well, because the focus of attention shifts away from performance based to high production volumes and in the direction of performance based to high product quality.
- *A major result of having an empowered workforce is that employees are allowed to stop their machines when they see a problem, and either fix it on the spot or immediately call in a repair team.* In either case the result is immediate resolution of the bulk of performance problems. This one step has a profound impact on much of the manufacturing variance analysis. Historically, management accountants compile all kinds of variance information at the end of each month, investigate problems in detail, and then present a formal problem analysis report to management a few weeks after the end of the month. However, because the production staff resolved the underlying issues within a few minutes of their occurrence, the variance report becomes a complete waste of time. Management no longer cares what happened a month in the past because it is presently dealing with current problems that will not appear on management accountant reports for weeks to come. In short, the quick response capabilities of a JIT system allows the management accountant to omit a large amount of the variance reporting that was previously an important central job function.
- This approach also means that there is no need for suppliers to send invoices, since the company relies solely on its internal production records to complete payments.

“Processes in which company alters in supporting accounting system”

- *Finally, the massive changes caused by a JIT system also requires several alterations in the supporting accounting systems.* Because of the large number of daily supplier shipments, the accounting staff faces the prospect of going through a large pile of accounts payable paperwork. To make the problem worse there is no receiving paperwork, because the suppliers deliver parts directly to the production operation, so there is no way to determine if deliveries have been made. *To avoid the first problem, accountants can switch to making a single consolidated monthly payment to each supplier. The second problem requires a more advanced solution. To prove that a supplier has delivered the part quantities which it claims it has, the accounting system that can determine the amount of finished products created during the period*

and then multiply these quantities by the parts listed on the bill of materials for each product, obtaining a total quantity for each part used. The accountants then pay suppliers based on this theoretical production quantity, which is also adjusted for scrap during the production process (otherwise suppliers—unfairly—will not be paid for their parts that are scrapped during the company's production process). This approach also means that there is no need for suppliers to send invoices, since the company relies solely on its internal production records to complete payments.

Clearly, the changes imposed by a JIT system are profound and can greatly improve company operations when installed and operated correctly. They can also have a profound effect on product costs.

So, JIT system aims at:

- Meeting customer demand in a timely manner
- Providing high quality products and
- Providing products at the lowest possible total cost.

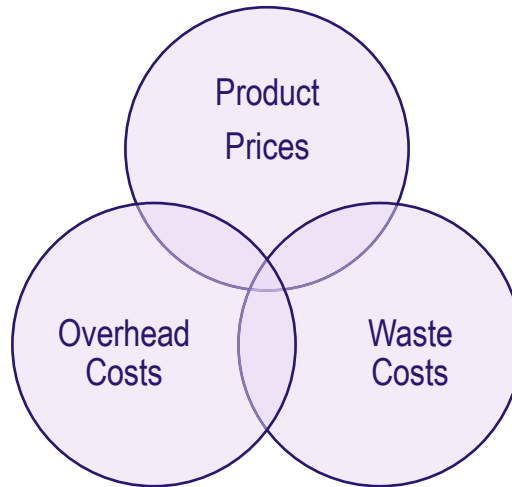
The five **main features** of JIT production system:

- Organise production in manufacturing cells, a grouping of all the different types of equipment used to make a given product. Materials move from one machine to another where various operations are performed in sequence. **Material – handling cost are reduced.**
- Hire and retain workers who are multi-skilled so that they are capable of performing a variety of operations, including repairs and maintenance tasks. Thus, **labour idle time gets reduced.**
- Apply TQM to eliminate defects. As, there are tight link stages in the production line, and minimum inventories at each stage, defect arising in one stage can hamper the other stages. **JIT creates urgency for eliminating defects as quickly as possible.**
- Place emphasis on reducing set-up time which makes production in smaller batches economical and reducing inventory levels. Thus, **company can respond to customer demand faster.**
- Carefully selected suppliers capable of delivering high quality materials in a timely manner directly at the shop – floor, reducing the material receipt time.

Essential Pre-requisites of a JIT system

- Low variety of goods
- Vendor reliability
- Good communication
- Demand stability
- TQM
- Defect free materials
- Preventive maintenance

Impact of JIT System on



- **Waste Costs:** A characteristic of the JIT system is its continuous focus on eliminating all waste from a system. This can be a waste of assets, excessive inventory. It can also be a waste of time, in the case of assets it may include unused assets for long periods of time (e.g., work-in-process inventory held in a production queue). It can also be a waste of materials, such as unnecessary levels of obsolete inventory, defective products, rework, and the like. When fully installed, a JIT system vastly reduce all these types of waste. When this happens, there is a sharp drop in several aspects of a product's costs.
- **Overhead Costs:** The costs of material handling, facilities, and quality inspection decline when a JIT system is installed. In addition, the reduction of all types of inventory results in a massive reduction in the amount of space required for the warehouse facility. Since all costs associated with the warehouse are assigned to the overhead cost pool, the amount of overhead is reduced when the costs of staff, equipment, fixed assets, facilities, and rent associated with the warehouse are sharply cut back.
- **Product Prices:** When a company achieves a higher level of product quality, along with ability to deliver products on the dates required, customers may be willing to pay a premium. This is particularly true in industries where quality or delivery reliability is low. If customers are highly sensitive to these two factors, it may be possible to increase prices substantially. Alternatively, if these factors are not of great importance, or if customers place a higher degree of importance on other factors, then there will be no opportunity for a price increase.

Performance Measurements in a JIT System

Many of the performance measurement measures used under a traditional accounting system are not useful in a JIT environment, while new measures can be implemented that take advantage of the unique characteristics of this system.

- **One of the key measurements in a traditional system is machine utilization:** This is used to ensure that every asset a company purchases is being thoroughly utilized. It is particularly

important in cases where there has been a large investment in automation or large, high-speed machinery, since these items are quite expensive and should be used to the utmost. However, making machine utilization a key measurement; forces production managers in the direction of manufacturing as much product as possible in order to show a high level of machine utilization, which can result in large amount of inventory piling up in the warehouse. This is not a desirable end result in a JIT environment, where producing only what is actually needed is the underlying rule. Also, machine cells in a JIT system tend to be smaller and less costly than the highly automated (and expensive) juggernauts used in more traditional systems, so there is less need to justify the investment in these smaller machines by proving that they have been heavily used. In short, machine utilization measurements can be discarded under JIT environment.

- **Another inappropriate measurement is any type of piece rate tracking for each employee:** This is a common measure in the textile industry, where employees are paid extra if they exceed certain production volume targets. However, a JIT system focuses on producing only what is needed, so an employee who has incentives to create vast piles of parts is producing contrary to the rules of the system. Accordingly, any piece rate system must be eliminated and replaced with measures that focus instead on the quality of output or the number of employee suggestions for improving the system, which are much more important outcomes in a JIT system.
- **Any type of direct labour efficiency tracking is highly inappropriate in a JIT system:** It is a key measurement in more traditional systems, where employee time and productivity are closely monitored and measured. However, a JIT system does not focus on how fast an employee works—only on the quality of the products manufactured. Also, labour variance measurements require considerable employee time tracking, which forces workers to fill in a time sheet, punch a clock, or use a barcoding system to track what they are doing and what job they are working on. All this labour tracking is a non-value-added activity, which is something a JIT system strive to avoid as an unnecessary activity. Consequently, the management accounting staff should advocate the complete elimination of all labour variance measurements.
- **Installing a JIT system does not mean that there should be a complete elimination of operational measures:** There are still several measures that are highly relevant to operations. Some of them are:

Inventory turnover: Those who have installed JIT systems emphasize the extraordinarily high inventory turnover that they now experience, which is the case in most instances. The turnover levels of such well-known JIT companies as Toyota have been known to exceed 70 per year, as opposed to the levels of 2 to 10 per year that are more common for companies with other types of manufacturing systems. This measure is best subdivided into smaller parts, so that one can determine the turnover levels for raw materials, work in process, and finished goods.

Setup time reduction: The average setup time per machine is of great importance as it can be measured periodically and plotted on a trend line. The shortest possible setup intervals are crucial for the success of short production runs, so this is a major JIT measurement. It is best

to measure it by machine, rather than in the aggregate, since an aggregate measure does not reveal enough information about which equipment requires more setup time reduction work.

Customer complaints: A JIT system is partly based on the premise that product quality will be superb. Consequently, any hint from customers that there are product problems should be greeted with the gravest concern and investigated immediately. The accumulation of customer complaints and their dissemination to management should be considered a major JIT measure.

Scrap: Little waste should be generated by a JIT system, which means that materials scrap should be driven down to exceedingly low levels. The cost of scrap (especially when supported by a detailed list of items that were scrapped) is of particular concern as a JIT system is being implemented, since it helps to identify problem areas requiring further management attention.

Cost of quality: One focus of JIT is on creating high-quality products, so it is reasonable to keep track of the full cost of quality (which comprises defect control costs, failure costs, and the cost of lost sales) on a trend line. Managers want to see the details behind this measure, so that they know where the largest quality costs still reside in the company and can then work to reduce them.

Customer service: This measure really has several components—delivering products on the dates required by customers, shipping full orders to customers, and not having products returned because of poor quality. This measure can be summarized in a variety of ways or reported at the component level, but the main issue is to measure and post the information for all to see, so that the company focuses strongly on providing the highest possible degree of customer service.

Ideas generated: A JIT system works best when employees pitch in with hundreds of suggestions for improvements that, when taken in total, result in a vastly improved, efficient operation. The amount of idea generation going on can be measured by the number of ideas per worker, the number of ideas suggested in total, the number of ideas implemented, or the proportion of ideas suggested that are implemented.

The common theme that unites all the JIT measures just listed is that they are not financial in nature (with the exception of the cost of quality)—they are operational measures that focus attention on the nuts-and-bolts details of creating and running a JIT system. A management accountant involved in the calculation and reporting of these measures may feel that this is quite a departure from the more traditional cost variance measures, but the end result will be a much more efficient JIT process that churns out and delivers high-quality products.

Back-flushing in a JIT System

Back-flushing requires no data entry of any kind until a finished product is completed. At that time the total amount finished is entered into the computer system, which multiplies it by all the components listed in the bill of materials for each item produced. This yields a lengthy list of components that should have been used in the production process and which are subtracted from the beginning inventory balance to arrive at the amount of inventory that should now be left on hand. Given the large transaction volumes associated with JIT, this is an ideal solution to the problem.

However, there are some serious problems with back-flushing that must be corrected before it will work properly. They are:

- **Production reporting:** The total production figure entered into the system must be absolutely correct, or else the wrong component types and quantities will be subtracted from stock. This is a particular problem when there is high turnover or a low level of training to the production staff that records this information, which leads to errors.
- **Scrap reporting:** All abnormal scrap must be diligently tracked and recorded; otherwise these materials will fall outside the back-flushing system and will not be charged to inventory. Since scrap can occur anywhere in a production process, a lack of attention by any of the production staff can result in an inaccurate inventory. Once again, high production turnover or a low level of employee training increases this problem.
- **Lot tracing:** Lot tracing is impossible under the back-flushing system. It is required when a manufacturer need to keep records of which production lots were used to create a product in case all the items in a lot must be recalled. Only a picking system can adequately record this information. Some computer system allows picking and back-flushing system to coexist, so that pick transactions for lot tracing purpose can still be entered in the computer. Lot tracing may then still be possible if the right software is available; however, this feature is generally present only on high-end systems.
- **Inventory accuracy:** The inventory balance may be too high at all times because the back-flushing transaction that relieves inventory usually does so only once a day, during which time other inventory is sent to the production process; this makes it difficult to maintain an accurate set of inventory records in the warehouse.

Of all the issues noted here, the worst is a situation where the production staff is clearly incapable of providing sufficiently accurate scrap or production reporting for the back-flushing system. If there is an easily traceable cause, such as less capable workers on a particular shift, moving a few reliable employees into these positions can provide immediate relief from the problem. It may even be possible to have an experienced shift supervisor to collect this information. However, where this is not possible for whatever reason, computer system users experience *back-flushing garbage in, garbage out (GIGO)*—entering inaccurate information rapidly eliminates any degree of accuracy in the inventory records, requiring many physical inventory counts to correct the problem. Consequently, the success of a back-flushing system is directly related to a company's willingness to invest in a well-paid, experienced well-educated production staff that undergoes little turnover.

JIT in Practice

Mahindra & Mahindra (M&M)

M&M wanted to implement JIT at their main plant in Nasik as they were aware of the fact that JIT approach will help them to operate with minimal levels of inventory. Their business objective was to make all our suppliers active participants" in the production process. They wanted that the suppliers should be "enabled" to know of any change in the whole production process and at the same time contribute actively. This was necessary to reduce the time-to-respond to a situation and help "just-in-time" approach in the production process.

Objective

- Make all the suppliers active participants in the production process.
- Suppliers should be able to know of any change in the whole production process and at the same time contribute actively.
- Update to best practices for supply strategies for 400 vendors, 150 vehicles per day and 1,100 parts.
- Improvement of the replenishment efficiency.
- Reduction of stock at the assembly line favouring a flexible manufacturing.

VSS Service

Concept planning for JIT and supply chain including definition of load units and their arrangement at the assembly line, definition of the replenishment trigger concept, design of stores and handling equipment and review of the method of supply from vendors.

Solution

Modular standard metal containers and totes based on Indian truck dimensions. Load units ergonomically presented to the workers.

25 JIT parts identified (supplied in sequence), two-tier shelving system for totes with dynamic allocation and picking, containerized supply from local vendors with round pick up.

Reduced personnel and replenishment lead time, improved manufacturing flexibility.

Benefits

- By making the suppliers participant in the 'just-in-time' method of production, they could maintain the least inventory level.
- Suppliers could see real time the status of the supplies, bill settlement and host of other parameters.
- All active participants of a process, for instance, the process from a supplier to the dealer can handle change management with the help of a particular solution and a defined process.
- Set up times are significantly reduced in the warehouse. Cutting down the set-up time to be more productive allowed the company to improve their bottom line to look more efficient.
- Having employee focused on specific areas of the system allowed them to process goods faster instead of having them vulnerable to fatigue from doing too many jobs at once and simplifies the tasks at hand.
- Increase emphasis on the supplier relationships.

Illustration

KP Ltd. (KPL) manufactures and sells one product called "KEIA". Managing Director is not happy with its current purchasing and production system. There has been considerable discussion at the corporate level as to use of 'Just in Time' system for "KEIA". As per the opinion of managing director of KPL Ltd. –

“Just-in-time system is a pull system, which responds to demand, in contrast to a push system, in which stocks act as buffers between the different elements of the system such as purchasing, production and sales. By using Just in Time system, it is possible to reduce carrying cost as well as other overheads”.

KPL is dependent on contractual labour which has efficiency of 95%, for its production. The labour has to be paid for minimum of 4,000 hours per month to which they produce 3,800 standard hours.

For availing services of labour above 4,000 hours in a month, KPL has to pay overtime rate which is 45% premium to the normal hourly rate of ₹110 per hour. For avoiding this overtime payment, KPL in its current production and purchase plan utilizes full available normal working hours so that the higher inventory levels in the month of lower demand would be able to meet sales of month with higher demand level. KPL has determined that the cost of holding inventory is ₹70 per month for each standard hour of output that is held in inventory.

KPL has forecast the demand for its products for the first six months of year 2019 as follows:

Month	Demand (Std. Hrs.)
Jan'19	3,150
Feb'19	3,760
Mar'19	4,060
Apr'19	3,350
May'19	3,650
Jun'19	4,830

Following other information is given:

- (i) All other production costs are either fixed or are not driven by labour hours worked.
- (ii) Production and sales occur evenly during each month and at present there is no stock at the end of Dec'18.
- (iii) The labour are to be paid for their minimum contracted hours in each month irrespective of any purchase and production system.

Required

As a chief accountant you are requested to COMMENT on managing director's view.

Solution**Workings****Statement Showing 'Inventory Holding Cost' under Current System**

Particulars	Jan	Feb	Mar	Apr	May	Jun
Opening Inventory* (A)	---	650	690	430	880	1,030
Add: Production*	3,800	3,800	3,800	3,800	3,800	3,800
Less: Demand*	3,150	3,760	4,060	3,350	3,650	4,830
Closing Inventory* (B)	650	690	430	880	1,030	---
Average Inventory $\left(\frac{A+B}{2}\right)$	325	670	560	655	955	515
Inventory Holding Cost @ ₹70	22,750	46,900	39,200	45,850	66,850	36,050

(*) in terms of standard labour hours

$$\begin{aligned} \text{Inventory Holding Cost for the six months} &= ₹2,57,600 \\ &= (₹22,750 + ₹46,900 + ₹39,200 + ₹45,850 + \\ &\quad ₹66,850 + ₹36,050) \end{aligned}$$

Calculation of Relevant Overtime Cost under JIT System

Particulars	Jan	Feb	Mar	Apr	May	Jun
Demand*	3,150	3,760	4,060	3,350	3,650	4,830
Production*	3,150	3,760	4,060	3,350	3,650	4,830
Normal Availability*	3,800	3,800	3,800	3,800	3,800	3,800
Shortage (=Overtime*) (C)	---	---	260	---	---	1,030
Actual Overtime Hours $\left(\frac{C}{0.95}\right)$	---	---	273.68	---	---	1,084.21
Overtime Payment @ ₹159.50 [110+45%]	---	---	43,652	---	---	1,72,931

(*) in terms of standard labour hours

$$\begin{aligned} \text{Total Overtime payment} &= ₹2,16,583 \\ &= (₹43,652 + ₹1,72,931) \\ \text{Therefore, saving in JIT system} &= ₹2,57,600 - ₹2,16,583 \\ &= ₹41,017 \end{aligned}$$

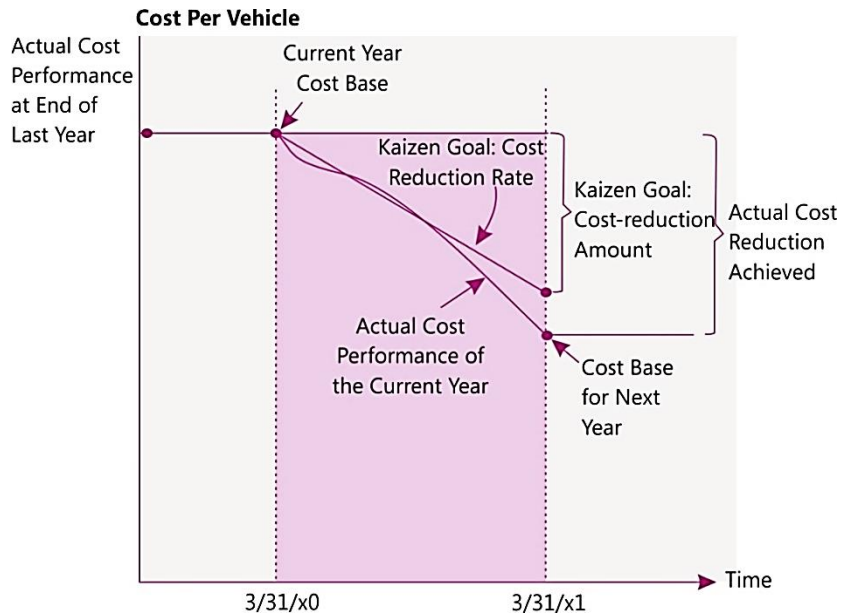
Comments

Though KPL is saving ₹41,017 by changing its production system to Just-in-time but it has to consider other factors as well before taking any final call which are as follows:-

- (i) KPL has to ensure that it receives materials from its suppliers on the exact date and at the exact time when they are needed. Credentials and reliability of supplier must be thoroughly checked.
- (ii) To remove any quality issues, the engineering staff must visit supplier's sites and examine their processes, not only to see if they can reliably ship high-quality parts but also to provide them with engineering assistance to bring them up to a higher standard of product.
- (iii) KPL should also aim to improve quality at its process and design levels with the purpose of achieving "Zero Defects" in the production process.
- (iv) KPL should also keep in mind the efficiency of its work force. KPL must ensure that labour's learning curve has reached at steady rate so that they are capable of performing a variety of operations at effective and efficient manner. The workforce must be completely retrained and focused on a wide range of activities.

**KAIZEN COSTING**

Lean manufacturing is founded on the idea of kaizen, or continual improvement. Continuous improvement is the continual examination and improvement of existing processes and is very different from approaches such as business process re-engineering (BPR), which seeks to make radical one-off changes to improve an organization's operations and processes. This philosophy implies that small, incremental changes routinely applied and sustained over a long period result in significant improvements. The kaizen strategy aims to involve workers from multiple functions and levels in the organization in working together to address a problem or improve a particular process.



Kaizen Costing Chart use by Daihatsu Motor Company (Osaka, Japan)

(Source: Managerial Accounting 7E By Hilton)

Some of the activities in the kaizen costing methodology include the elimination of waste in the production, assembly, and distribution processes, as well as the elimination of work steps in any of these areas. Though these points are also covered in the value engineering phase of target costing, the initial value engineering may not uncover all possible cost savings. Thus, kaizen costing is really designed to repeat many of the value engineering steps for as long as a product is produced, constantly refining the process and thereby stripping out extra costs. The cost reductions resulting from kaizen costing are much smaller than those achieved with value engineering but are still worth the effort 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 while continuing to reduce cost.

Kaizen Costing Principles

- The system seeks gradual improvements in the existing situation, at an acceptable cost.
- It encourages collective decision making and application of knowledge.
- There are no limits to the level of improvements that can be implemented.
- Kaizen involves setting standards and then continually improving these standards to achieve long-term sustainable improvements.
- The focus is on eliminating waste, improving systems, and improving productivity.
- Involves all employees and all areas of the business.

Case Scenario

M. India Ltd. (MIL) is an automobile manufacturer in India and a subsidiary of Japanese automobile and motorcycle manufacturer Leon. It manufactures and sells a complete range of cars from the entry level to the hatchback to sedans and has a present market share of 22% of the Indian passenger car markets. MIL uses a system of standard costing to set its budgets. Budgets are set semi-annually by the Finance department after the approval of the Board of Directors at MIL. The Finance department prepares variance reports each month for review in the Board of Directors meeting, where actual performance is compared with the budgeted figures. Mr. Suzuki, group CEO of the Leon is of the opinion that Kaizen costing method should be implemented as a system of planning and control in the MIL.

Required

RECOMMEND key changes vital to MIL's planning and control system to support the adoption of 'Kaizen Costing Concepts'.

Solution

Kaizen Costing emphasizes on *small but continuous improvement*. Targets once set at the beginning of the year or activities are *updated continuously* to reflect the improvement that has already been achieved and that are yet to be achieved.

The suggestive changes which are required to be adopted Kaizen Costing concepts in MIL are as follows:

Standard Cost Control System to Cost Reduction System: Traditionally Standard Costing system assumes stability in the current manufacturing process and standards are set keeping the normal manufacturing process into account thus the whole effort is on to meet performance cost standard.

On the other hand Kaizen Costing believes in continuous improvements in manufacturing processes and hence, the goal is to achieve cost reduction target. The first change required is the standard setting methodology i.e. from earlier Cost Control System to Cost Reduction System.

Reduction in the periodicity of setting Standards and Variance Analysis: Under the existing planning and control system followed by the MIL, standards are set semi-annually and based on these standards monthly variance reports are generated for analysis. But under Kaizen Costing system cost reduction targets are set for small periods say for a week or a month. So the period covered under a standard should be reduced from semi-annually to monthly and the current practice of generating variance reports may be continued or may be reduced to a week.

Participation of Executives or Workers in standard setting: Under the Kaizen Costing system participation of workers or executives who are actually involved in the manufacturing process are highly appreciated while setting standards. So the current system of setting budgets and standards by the Finance department with the mere consent of Board of Directors required to be changed.

Kaizen Costing in Practice

Kaizen Costing becomes part of the Package At the start of 2002 a UK company called Kappa Packaging (now part of the Smurfit Kappa Group) had a factory in Greater Manchester that made, among other products, cartons to hold bottles of drink. That year the firm introduced a new approach to cutting the amount of waste paper and cardboard it was producing, which stood at 14.6 per cent of the raw materials consumed. The new approach included the following initiatives: a) Making employees more aware of how much waste was being produced. b) Requiring them to monitor the amount of waste for which they were individually responsible. c) Establishing a Kaizen team to find ways of reducing waste. As a result, Kappa was able to reduce waste from 14.6 per cent to 13.1 per cent of raw materials used by the end of 2002 and down to 11 per cent in 2003. Each percentage-point saving was worth an estimated £110,000 a year.

(Source: "Accurate measurement of process waste leads to reduced costs", www.envirowise.gov.uk, 2003.)



5S is the name of a workplace organization method that uses a list of five Japanese words: **seiri**, **seiton**, **seiso**, **seiketsu**, and **shitsuke**. It explains how a work space should be organized for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items, and sustaining the new order.

There are 5S phases: They can be translated from the Japanese as “**sort**”, “**set in order**”, “**shine**”, “**standardize**”, and “**sustain**”

Sort (Seiri)

- Make work easier by eliminating obstacles and evaluate necessary items with regard to cost or other factors.
- Reduce chances of being disturbed with unnecessary items.
- Prevent accumulation of unnecessary items.

Set In Order (Seiton)

- Arrange all necessary items into their most efficient and accessible arrangements so that they can be easily selected for use and make workflow smooth and easy.
- Ensure first-in-first-out FIFO basis, so that it is easy to find and pick up necessary items.
- Place components according to their uses, with the frequently used components being neared to the work.

Shine (Seiso)

- Clean your workplace on daily basis completely or set cleaning frequency.

- Keep workplace safe, easy to work, clean and pleasing to work in.
- In an unfamiliar environment, people must be able to detect any problems within 50 feet.

Standardize (Seiketsu)

- Standardize the best practices in the work area.
- Maintain high standards, orderliness, everything in order and according to its standard.
- Every process has a standard.

Sustain (Shitsuke)

- Not harmful to anyone, training and discipline, to maintain proper order.
- Also translates as “do without being told”.
- Training is goal-oriented process. Its resulting feedback is necessary monthly.

5S in Lean Product & Process Development

Information is the output of engineering and design in a lean enterprise, the theory behind using 5S here is “Dirty, cluttered, or damaged surfaces attract the eye, which spends a fraction of a second trying to pull useful information from them every time we glance past. Old equipment hides the new equipment from the eye and forces people to ask which to use.”

5S methodology is being applied to a wide variety of industries including Manufacturing, Health care, Education & Government.

Case Scenario

Y & E Chartered Accountants offers a wide range of specialized, multi-disciplinary professional services that meet the immediate as well as the long-term business needs of clients. One of partner ‘E’ was upset with office documentation. ‘E’ argued that a document management solution is needed to maximize efficiency within the firm. The senior partner ‘Y’ has recently attended a seminar on lean system and heard the ‘5S’. He said that old files hide the key files from the eye and forces staff to ask which to use. Accordingly, he desires to implement ‘5S’.

Required

ADVISE on implementation of ‘5S’ in Y & E.

Solution

Office processes often have huge amounts of paperwork and this not only makes processes slower but also allows errors to be introduced. 5S is a method of both cleaning out the working area and maintaining the cleanliness to improve process quality. The 5S process is based on:

Sort (Seiri)

This is sorting and removal of unnecessary files, papers, books and documents in the work area. Sorting is designed to make the work area neat, organized and arranged so that relevant items can be found easily. If an item is not relevant for the work, then it should not be in the work area.

Set in Order (Seiton)

Set in order means systematic arrangement of things i.e. arrange all necessary items into most efficient and accessible arrangement so that they can be easily be identified for use. It is advisable to have proper indexing of files and proper documentation i.e. proper index should be made and pasted on each file about its contents and in that pattern of contents, documents should be kept inside the files so that specific document can easily be traced and withdrawn on time. Even inside cupboard, paper of indexing about files with its name should be pasted so that specific file can easily be traced. Same can be done w.r.t. folders in computer, right file should be saved in right folder with identifiable name so that anyone can easily find any file. Frequent use items should be close by and infrequent use items can be further away in a central area. All storage areas should be clearly labelled to allow items to be put in the correct place, e.g. where did I leave the office stamp again?

Shine (Seiso)

After sorting and simplifying, it is necessary to keep the work area clean and safe. Shining is also an inspection process for the area, i.e. is everything in good condition. It is desirable to involve employees for 15-20 minutes each day to clean the work area so that they can have the habit of cleanness. In the same way, unimportant files either in desktop or any driver should be permanently deleted.

Standardize (Seiketsu)

A clean and tidy work area allows the process to be standardized and examined for quality or process improvements. Best practices are documented and rolled out across the work area, standards and process measures are established and displayed in the work area.

For example, red file can be standardized for very important files (can be required anytime), green file for important files and yellow file for unimportant files.

Sustain (Shitsuke)

It means to maintain discipline, this can only be achieved by auditing work areas and processes to make sure that the 5S standards are maintained. It is worthwhile to apply 5S standards continuously i.e. daily basis and check for any upgradation if needed, so that firm can have good management in terms of documentation, cleanness, time saving of partners as well as clients.

Overall, 5S in offices streamlines the work (low to reduce errors as well as improving process times) and employee satisfaction.

Application of 5S

Application in Web Based App that Needs a Screen Interface

- **Seri (sort)**- Seri can be thought as a sorting through features, interface elements, and screens to minimize an application or a single screen to its most essential parts.
- **Seiton (set in order)**- Seiton is about designing for uniformity so that users can derive meaning from a page's content based on how it is laid out.
- **Seiso (shine)**- Seiso can relate to improving or updating the look of graphical elements, devoting attention to more perfect alignment and distribution amount page elements, and devising colour palettes that contribute to the overall mood and personality of the application.
- **Seiketsu (standardize)**- Online, adhering to standards means using proper semantic mark up in webpages and keeping the code used for presentation and content clearly separated.
- **Shitsuke (sustain)**- Improvement should not come in smart waves and then fade away. It should be kept on permanent basis. The repeated process of reduction to retain only what's needed in a screen application, the arrangement of elements into most effective forms, the polishing of what's left and the standardisation of screen are the processes that should be maintained.

(Source: Designing the Obvious: A Common Sense Approach to Web & Mobile Application, By Robert Hoekman Jr.)



TOTAL PRODUCTIVE MAINTENANCE (TPM)

Total Productive Maintenance (TPM) is a system of maintaining and improving the integrity of production and quality systems. This is done through the machines, equipment, processes, and employees that add to the value in Business Organisation. This concept was first introduced by M/s Nippon Denso Co. Ltd. of Japan, a supplier of M/s Toyota Motor Company.

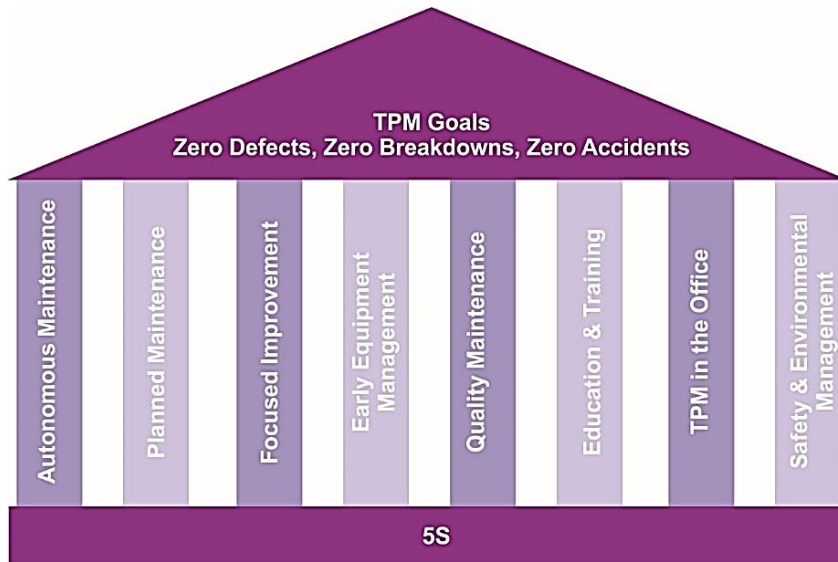
TPM helps in keeping all equipment in top working condition so as to avoid breakdowns and delays in manufacturing processes.

How TPM can be introduced in the organization?

The introduction of TPM follows four main phases:

- Preparation Stage: Establish a suitable environment and conducting programme awareness.
- Introduction Stage: Initialization of TPM, information to suppliers, customers, and other stakeholders.
- Implementation Stage: This is done with the help of eight activities referred as eight pillars of TPM.
- Institutionalizing stage: This is the stage of getting TPM awards.

TPM Strategy focuses on **eight pillars** of success with 5S strategy as foundation.



Foundation & Pillars	About	Techniques
Foundation: 5S	TPM starts with 5S. It deals with organizing a workplace which helps to recognize the uncover problems.	Seiri (sort), Seiton (set in order) Seiso, (shine), Seiketsu (standardize), Shitsuke, (sustain).
P-1: Autonomous Maintenance	Operation of equipment <i>without breakdown</i> and eliminating the defects at source through active employee participation.	Cleaning, Lubricating, Visual Inspection, Tightening of Loosened Bolts etc.
P-2: Focussed Improvement (Kaizen)	This pillar is about the <i>minor improvements made on continuous basis</i> . This pillar aims to reduce losses in the workplace that affect efficiencies.	Kaizen Register, Kaizen Summary Sheet, Why-Why Analysis, Summary of Losses.
P-3: Planned Maintenance	This is <i>proper maintenance system</i> adopted for improvement in reliability and maintainability of equipment. It aims to have zero breakdown and optimum maintenance cost.	Preventive Maintenance, Breakdown Maintenance, Corrective Maintenance, and Maintenance Prevention.
P-4: Early Management	This focuses on <i>shortening the time required</i> for product and equipment development.	Engineering and Re-engineering Processes.

P-5: Quality Maintenance	This is towards achieving <i>customer satisfaction</i> through delivery of highest quality product.	Root Cause Analysis, Customer Data Analysis.
P-6: Education & Training	It aims to improve knowledge/skills and enhance morale of employees.	Training Calendar, Policies for Education and Training, On-site Training etc.
P-7: Office TPM	This refers to application of TPM techniques in administration to improve productivity and efficiency in the functions with elimination of losses.	Analyzing processes and procedure towards increased Office Automation.
P-8: Safety, Health, and Environment	Above all the safety of worker is utmost importance. It aims to have zero accidents and zero health damages.	Drama, Safety Slogans, Quizzes, Posters Making to create awareness related to safety.

Performance Measurement in TPM¹

The most important approach to the measurement of TPM performance is known as Overall Equipment Effectiveness (OEE) measure. The calculation of OEE measure requires the identification of “six big losses”

1. Equipment Failure/ Breakdown
2. Set-up/ Adjustments
3. Idling and Minor Stoppages
4. Reduced Speed
5. Reduced Yield and
6. Quality Defects and Rework

The first two losses refer to time losses and are used to calculate the availability of equipment. The third and fourth losses are speed losses that determine performance efficiency of equipment. The last two losses are regarded as quality losses.

$$\text{Performance} \times \text{Availability} \times \text{Quality} = \text{OEE} \%$$

OEE may be applied to any individual assets or to a process. It is unlikely that any manufacturing process can run at 100% OEE. According to Dal *et al* (2000), Nakajima (1998) suggested that ideal values for the OEE component measures are:

Availability	> 90%
Performance	> 95%
Quality	> 99%

Accordingly, OEE at World Class Performance would be approximately 85%. Kotze (1993) contradicted, that an OEE figure greater than 50% is more realistic and therefore more useful as an acceptable target.

(1. Source: "Factors Affecting the Implementation of a Total Productive Maintenance By Norman Herrmann")

Illustration

Gold Coast Company Ltd. manufactures spare parts. It works in two shifts of 8 hours for 6 days in a week. Lunch break is 45 mins and other miscellaneous breaks add up to 25 minutes. The following details are collected for the last 4 weeks by the TPM team for one of their important equipment

Hours for Planned Preventive Maintenance = 15 minutes per shift

For Breakdown Maintenance = 6 hours total

Set up Changes = 15 hours total

Power Failure = 4 hours total

Standard Cycle Time per piece = 3 minutes

No of Parts Produced per shift = 120

Parts Accepted per shift = 115

Required

CALCULATE 'OEE'.

Solution

Calculation of Shifts

Days per week	...(A)	6
Shifts per week	...(B)	2
Total Working Shifts per week	...(C = A × B)	12
Total Weeks	...(D)	4
Total Shifts	...(E = C × D)	48

Calculation of Loss of Time per shift

Breakdown Maintenance (in mins)	360
Set up Changes (in mins)	900
Power Failure (in mins)	240
Total	...(A) 1,500
Loss of Minutes per shift	...(A/ 48) 31.25

Add: Lunch Breaks <i>per shift</i>	45
Add: Other Breaks	25
Add: Preventive Maintenance	15
Total Time Loss (in Minutes) <i>per shift</i>	116.25

$$\text{Availability Ratio per shift} = \left\{ \frac{480 \text{ mins.} - 116.25 \text{ mins.}}{480 \text{ mins.}} \right\} \times 100\%$$

$$= 75.78 \%$$

$$\text{Actual Production} = 120 \text{ units per shift}$$

$$\text{Standard time} = 3 \text{ minutes}$$

$$\text{Standard Time Required} = 120 \text{ units} \times 3 \text{ minutes}$$

$$= 360 \text{ minutes}$$

$$\text{Actual Time Taken} = 480 \text{ mins.} - 116.25 \text{ mins.}$$

$$= 363.75 \text{ minutes}$$

$$\text{Performance Ratio} = \left\{ \frac{360 \text{ mins.}}{363.75 \text{ mins.}} \right\} \times 100\%$$

$$= 98.96\%$$

$$\text{Quality Ratio} = \left\{ \frac{115 \text{ parts}}{120 \text{ parts}} \right\} \times 100\%$$

$$= 95.83\%$$

$$\text{Thus, OEE} = 0.7578 \times .9896 \times .9583 = 71.86\%$$

Connection Between TQM and TPM

The connection between TQM and TPM are summarized below:

- TQM and TPM make company more competitive by reducing costs, improving customer satisfactions and slashing lead times.
- Involvement of the workers into all phases of TQM and TPM is necessary.
- Both processes need fundamental training and education of participants.
- TPM and TQM take long time to notice sustained tangible benefits.
- Commitment from top managements are necessary for success of the implementation.



CELLULAR MANUFACTURING/ ONE PIECE FLOW PRODUCTION SYSTEM

A Sub Section of JIT and Lean System is Cellular Manufacturing. It encompasses a group technology. The goals of cellular manufacturing are:

- To move as quickly as possible,
- Make a wide variety of similar products,
- Making as little waste as possible.

In the assembly line multiple cells are used. Each cell comprises of one or more machines which accomplish a certain task. The product moves from one cell to the next, each station completing part of the manufacturing process. U-shaped design is given to these cells because this allows for the supervisor to move less and have the ability to more readily watch over the entire process.

Flexibility in operations is its biggest advantage. Changes are easy to make as the machines are automatic. Variety, of product scaling is possible and minor changes to the overall design are made possible changing the overall design. Although boring the changes can be done precisely and quickly.

A cell is created by consolidating the processes required to create a specific output, such as a part or a set of instructions. Reduction is the extra steps are done in the process of creating the specific output, and facilitate quick identification of problems and encourage communication of employees within the cell in order to resolve issues that arise quickly. It gives massive Gains on implementation in productivity and quality while simultaneously reducing the amount of inventory, space and lead time required to create a product. It is for this reason that the one-piece-flow cell has been called "the ultimate in lean production".

Implementation Process

In order to implement cellular manufacturing, a number of steps must be performed.

First, the parts to be made must be grouped by similarity (in design or manufacturing requirements) into families.

Then a systematic analysis of each family must be performed; typically in the form of production flow analysis (PFA) for manufacturing families, or in the examination of design/product data for design families. This analysis can be time consuming and costly, but is important because a cell needs to be created for each family of parts.

There are also a number of mathematical models and algorithms to aid in planning a cellular manufacturing center, which take into account a variety of important variables such as, "multiple plant locations, multi-market allocations with production planning and various part mix."

Once these variables are determined with a given level of uncertainty, optimizations can be performed to minimize factors such as, "total cost of holding, inter-cell material handling, external transportation, fixed cost for producing each part in each plant, machine and labor salaries."

Difficulties in Creating Flow

Following difficulties need to be considered and addressed to create efficient flow in cellular manufacturing:

- Exceptional Elements
- Machine Distances
- Bottleneck Machines and Parts
- Machine Location and Relocation
- Part Routing
- Cell Load Variation
- Inter and Intracellular Material Transferring
- Cell Reconfiguring
- Dynamic Part Demands and
- Operation and Completion Times

Benefits and Costs

Scattered processes are merged to form short focused paths in concentrated places. So constructed, by logic a cell reduces flow time, flow distance, floor space, inventory, handling, scheduling transactions, and scrap and rework (the latter because of quick discovery of nonconformities). Moreover, cells lead to simplified, higher validity costing, since the costs of producing items are contained within the cell rather scattered in distance and the passage of reporting time.

Production and quality controls are facilitated. Cells that are underperforming in either volume or quality can be easily isolated and targeted for improvement. The segmentation of the production process allows problems to be easily located and it is more clear which parts are affected by the problem.

There are also a number of benefits for employees working in cellular manufacturing. The small cell structure improves group cohesiveness and scales the manufacturing process down to a more manageable level for the workers.

Workers can more easily see problems or possible improvements within their own cells and tend to be more self-motivated to propose changes. Additionally, these improvements that are instigated by the workers themselves cause less and less need for management, so over time overhead costs can be reduced.

There are a number of possible limitations to implementing cellular manufacturing. Some argue that cellular manufacturing can lead to a decrease in production flexibility. Cells are typically designed to maintain a specific flow volume of parts being produced. Should the demand or necessary quantity decrease, the cells may have to be realigned to match the new requirements, which is a costly operation, and one not typically required in other manufacturing setups.



SIX SIGMA

Engineer Bill Smith introduced Six Sigma while working at Motorola in 1986. Six Sigma became well known after Jack Welch made it a focus of his business strategy at General Electric in 1995, and today it is widely used in many sectors of industry. It is quality improvement technique whose objective to eliminate *defects* in any aspect that affects customer satisfaction. The premise of Six Sigma is that by measuring defects in a process, a company can develop ways to eliminate them and practically achieve “zero defects”. Six sigma can be used with balanced scorecard by providing more rigorous measurement system based on statistics. The primary focus of Six Sigma is on:

- Customer satisfaction.
- Decisions based on data-driven facts.
- Management, improvements, and processes.
- Proactive management team.
- Collaboration with in the business
- Goal for perfection.

Numerical Concept of Six Sigma

'Sigma' is a statistical term that measures how far a process deviates from perfection. The higher the sigma number, the closer the process is to perfection.

The values of Defect Percentage

Six Sigma is 3.4 defects per million opportunities or getting things right 99.99966% of the time. It is possible to develop ways of reducing defects by measuring the level of defects in a process and discovering the causes.

The Value of the Defect Percentage Under Various Sigma Levels

Sigma Level	Defects per Million Opportunities (DPMO)	Percentage Defective (%)	Percentage Yield (%)	Quality/ Profitability
1 σ	6,91,462	69	31	Loss
2 σ	3,08,538	31	69	Non-Competitive
3 σ	66,807	6.7	93.3	Average Industries
4 σ	6,210	0.62	99.38	Above Average
5 σ	233	0.023	99.977	Below Maximum Productivity
6 σ	3.4	0.0034	99.99966	Near Perfection

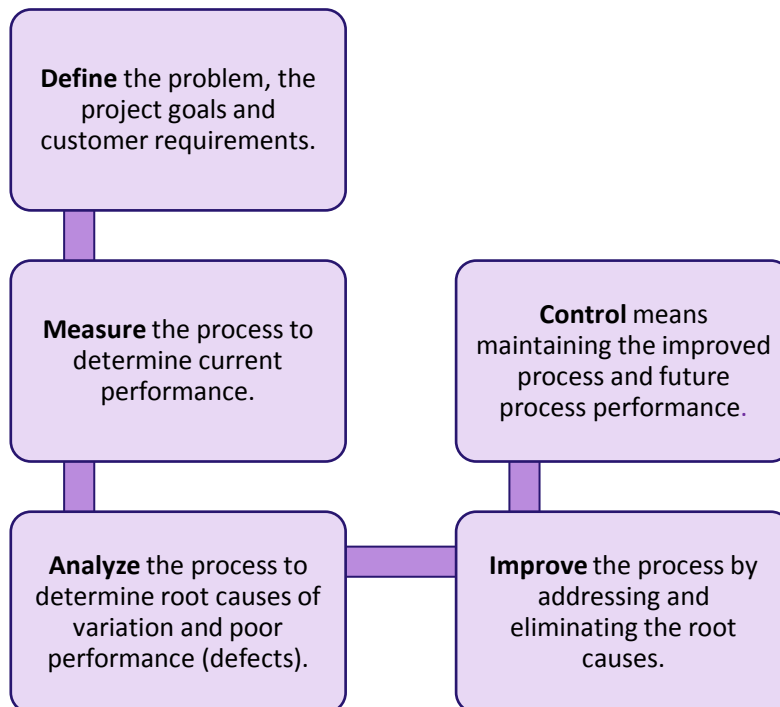
The second last column (in above table) indicates the percentage of values that lie within the *control limits*. The more popular measure, the number of defects per million opportunities, is indicated in second column.

It may not be possible to achieve 'perfect Six Sigma' but relevant benefits can be achieved from a rise from one Sigma Level to another.

Implementation of Six Sigma

There are two methodologies for the implementation of Six Sigma-

DMAIC: This method is very robust. It is used to improve *existing* business process. To produce dramatic improvement in business process, many entities have used it successfully. It has *five phases*:



DMAIC is used under the following circumstances:

- A product or process exists.
- The project is part of ongoing continuous improvement process.
- Only a single process needs to be altered.
- Competitor's actions are stable.
- Customer's behaviour is unchanging.
- Technology is stable.

Application of DMAIC in the Banking Sector

In banking sector, DMAIC may be used as follows:

- **Define:** Customer satisfaction & loyalty have significant impact on financial performance of a bank. Six Sigma involves defining objectives and opportunities to improve (based on customer's feedback or complaints) in discussion with staff.
- **Measure:** In this phase, Six Sigma experts deploy quantitative procedures to collect statistical data. Then the statistical data is used for measuring the impact of the various processes on customer satisfaction. Different processes may have different impact on customer satisfaction. The measurement of impact of the individual processes helps the banks to concentrate on improving the processes that have the maximum impact on customer satisfaction. In the banking industry, wait times are said to have the maximum impact on customer satisfaction.
- **Analyse:** In this phase, Six Sigma experts analyse the data collected in accordance with the parameters set for improvement. So that, the processes (that directly affects customer's satisfaction) can be improved at minimum cost.
- **Improve:** In this phase, experts take corrective measures to improve processes in consultation with staff based on facts and statistics. Advanced statistical tools can also be used to study the impact of the proposed improvement initiative on business processes.
- **Control:** Control systems should be put in place to monitor the impact of the improvement initiatives through periodical review performance. If still a business process is not performing well in accordance with the desired Six Sigma levels, the process is referred back to the 'define' phase. However, if a small problem is impacting the performance, then corrective measures are taken and the whole process is not referred back.

(Reference: <http://www.sixsigmaonline.org>)

Case Scenario

Derby Grey is leading manufacturer of leather luggage bags (up to 62") for the style-conscious people around the globe. It is made up of two independent divisions in New Delhi. The division 'Mx' performs all manufacturing and packaging operations. All sales are made through the division 'Rx' which has 11 retail stores in New Delhi, as well as through Derby Grey's own well-developed website. Derby Grey has also retail operations in Dubai, Kuala Lumpur, Bangkok as well as in Singapore. These overseas businesses operate as independent subsidiaries within the Division 'Rx'.

Derby Grey revolutionized the industry by offering cheap but stylish luggage bags. Derby Grey is able to keep its prices low by offering a very basic level of service. Luggage Bags are sold in boxes for customers to assemble themselves and all deliveries are made through third party distributor 'Costa Cruise'.

Dr. Philips (Managing Partner) is bothered about increasing sales returns and massive complaints about product purchased from Derby Grey on social media. With this concern, Dr. Philips has appointed you as performance management expert to help the firm to execute six sigma technique to reduce number of sales returns and to evaluate firm's existing performance.

Dr. Philips has heard that Six Sigma analysis involves large quantities of data. Dr. Philips stated–

"I'm not confident on our current IT systems. I doubt whether system would be able to identify the required data related to cutting, preparation, closing, lasting etc. These manufacturing sub divisions may be the root causes of the problem. Further, quarterly compiled sales return data has not enough detail. We may need to do more analysis on customer satisfaction and manufacturing quality."

You have been given access to feedback given by customers for returning goods to measure existing performance in this area (refer below):

Difficult to assemble or pieces missing (47%) – Bags were not as demanded (24%) – Poor Quality (19%) – Arrived damaged (9%) – Arrived late (1%)

Required

ADVISE Managing Partner on Six Sigma implementation to reduce number of sales return using DMAIC method.

Solution

DMAIC is a methodology of Six Sigma used to improve existing business process. It is advisable to Managing Partner to execute following phases of DMAIC–

Define the process

This phase emphasizes exactly *what customer's requirements are?* In this case focus is precisely on *why bags are returned*. The objective of the process needs to be clear as in this case to *reduce the number of customer returns*. Customers expect certain minimum requirements from the manufacturing and packaging process, for example, that the bags are properly packed in boxes. They also expect the goods be delivered undamaged within a reasonable time and delivered at the time and date when committed. Further, customer's perceptions of quality should coincide with the price paid, though different customers may have different expectations.

Measure the existing process

This phase measure the process to determine existing performance. In this case, the sales returns figures do not show complete picture as to why customers return bags, which of the class belong to 'poor packing', which one belong to 'defective item', which one belong to 'activities of other sub divisions' etc. The *ambiguity of the data and classification of definitions will need to be addressed* as to enable the process to be measured effectively.

Analyse

This phase *detects the root cause* of the problems. Possible root cause of sales return are as follows:

- Difficult to assemble or pieces missing (47%) – Returns could be because the bags were not manufactured or packed properly in the 'Mx' division, but could also be due to poor design, customers losing pieces or simply being unable to assemble bag.
- Bags were not as demanded and of poor quality (43%) – Returns could be due to defective manufacture or if the customer had merely changed their minds and no longer required the bag. In 'bags were not as demanded', the identification of 'defective items' are too vast.
- Arrived damaged (9%) – It may be that customers wrongly classified defective bags as damaged. Though bags may become damaged by the 'Çosta Cruise', only a small number of returns relate directly to them.
- Arrived late (1%) – Reasons of arrived late could be either 'Costa Cruise' could not make delivery on time or 'Mx' division could not complete order on time and this causes only 1% of returns, is relatively insignificant.

Further, information could be analysed, like country wise sales returns, product wise sale, or with *more clear definition of 'defective items' from customer's perspective*. By doing so, firm may easily get information related to areas of the business where sales returns are high and hence be able to focus on.

Improve

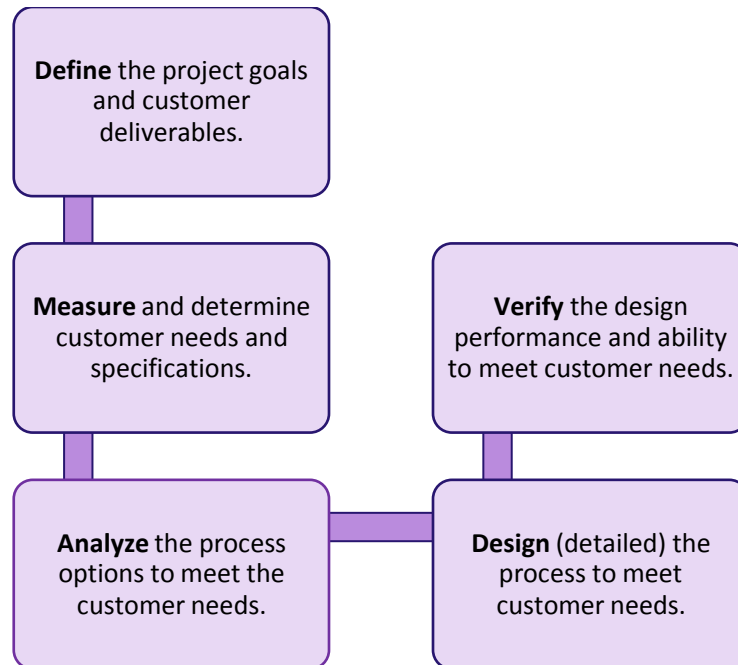
In this phase, recommendations are made to *minimize or eliminate the root cause* of the problem and then those recommendations are implemented to improve the process in a systematic manner. Derby Grey is required to *consider aspects of production or packaging which could be improved*, for example, timely repair and maintenance of equipment or training to existing staff etc. Further, *availability of resources and likely costs of making the improvements* need to be carefully considered.

Control

Here control means *maintaining the improved performance and future performance*. Derby Grey would be required to monitor the performance ongoing basis. If sales return reach above particular level, it should be reported to responsible person and he should act immediately.

In addition, Derby Grey need to redesign IT system in such a way so that it can provide required detail. Since this is continuous monitoring so it may also require revisiting of some phases in DMAIC.

DMADV: The application of these methods is aimed at creating a high-quality product keeping in mind customer requirements at every stage of the product. It is an improvement system which is used to develop *new processes or products* at Six Sigma quality levels. Phases are described in diagram:



DMDAV is used under the following circumstances:

- A product or process is not in existence
- Existing process has been optimised using either DMAIC or some other process.
- Project have strategic importance.
- Multiple process need to be altered.
- Competitor's performance is changing.
- Customer's behaviour is changing.
- Technology is growing.

Similarities between DMADV and DMAIC

- Both of these six sigma methodologies are based on defects per million opportunities (DPMO).
- Both DMADV and DMAIC use the same kind of six sigma quality management tools.
- Customer's needs are the basic parameter for both six sigma methodologies.

Both DMADV and DMAIC are fundamental six sigma methodologies for improving quality of product/process. Broadly, DMAIC deals with improving some existing process to make it align with customer's needs while DMADV deals with new design or redesign.

Difference DMAIC and DMADV

Following table highlights the differences between DMAIC and DMADV.

DMAIC	DMADV
Review the <i>existing processes</i> and fixes problem(s)	Emphases on the design of the product and processes.
More <i>reactive</i> process.	<i>Proactive</i> process.
Increase the <i>capability</i> .	Increase the <i>capacity</i> .
Rupee benefits <i>quantified</i> rather <i>quickly</i> .	Rupee benefits more <i>difficult to quantify</i> and tend to be <i>much more long term</i> .
Examples of DMAIC <i>problem-solving</i> methods: <ul style="list-style-type: none"> ▪ Reduce the cycle time to process a patent. ▪ Reduce the number of errors in sales list. ▪ Improve search time for critical information. 	Examples of procedures that the DMADV <i>development method</i> is designed to address: <ul style="list-style-type: none"> ▪ Add a new service ▪ Create a real-time system. ▪ Create a multiple-source lead tracking system

Quality-Management Tools

Six Sigma utilizes many established Quality-Management Tools. Below are just a few of them.

- **Control Chart** – It is a statistical chart, monitors variance in a process over time and alerts the business to unexpected variance which may cause defects.
- **Histogram** – Histogram helps in prioritizing factors and identify which are the areas that needs utmost attention immediately.
- **Pareto Diagram** – Pareto chart revolves around the concept of 80-20 rule i.e. 80% of the defects of a process come from 20% of the causes. It focuses on the problems that have the greatest potential for improvement.
- **Process Mapping** – It is a work flow diagram of how things get done. It helps reduce cycle time and defects.
- **Root Cause Analysis** – A root cause is a factor that caused a non-conformance and should be permanently eliminated through process improvement.
- **Statistical Process Control** – The application of statistical methods to analyze data, study and monitor process capability and performance.
- **Tree Diagram** – Graphically shows the key goals, their sub-goals, and key tasks. It inspires team members to expand their thinking when creating solutions.
- **Cause and Effects Diagrams** – Cause-and-effect diagram helps in identifying the various causes (or factors) of a given effect (or problem).

Limitations of Six Sigma

- Six Sigma focuses on quality only.
- Six Sigma does not work well with intangible results.

- Substantial infrastructure investment is required.
- Six Sigma is complicated for some tasks.
- Not all products need to meet Six Sigma standards.
- Six Sigma focuses on specific type of process only.
- There are lot to real time barriers which needs to be resolved while translating the theoretical concepts into practical applications.

Lean Six Sigma

Lean Six Sigma is the combination of Lean and Six Sigma which help to achieve greater results that had not been achieved if Lean or Six Sigma would have been used individually. It increases the speed and effectiveness of any process within any organization. By using lean Six Sigma, organisations will be able to Maximize Profits, Build Better Teams, Minimize Costs, and Satisfy Customers.

Six Sigma in Practice

Wipro

Wipro is the first Indian company to adopt Six Sigma. Today, Wipro has one of the most mature Six Sigma programs in the industry ensuring that 91% of the projects are completed on schedule, much above the industry average of 55%.

Six Sigma at Wipro simply means a measure of quality that strives for near perfection. It is an umbrella initiative covering all business units and divisions so that it could transform itself in a world class organization. At Wipro, it means

Have products and services meet global benchmarks.

Ensure robust processes within the organization.

Consistently meet and exceed customer expectations.

Make Quality a culture within.

Six Sigma training.

Wipro is using Six Sigma at present on over 500 projects in multiple areas including, project management, market development and resource utilisation.



PROCESS INNOVATION AND BUSINESS PROCESS RE-ENGINEERING

Business Process Re-engineering (BPR) and Process Innovation (PI) are similar concepts that emerged in the early 1990s. BPR focuses on amending *existing processes*, while PI attempts to implement *new processes* into an organisation. In many ways, PI is more radical than BPR, because it is changing the overall structure of an organisation, whereas BPR is streamlining processes that are already in place.



PROCESS INNOVATION

Process Innovation means the implementation of a new or significantly improved production or delivery method (including significant changes in techniques, equipment and/ or software). Changes, improvements, increase on product or service capability done by addition in manufacturing or logical system, ceasing to use a process, simple capital replacement or extension, changes resulting purely from changes in factor prices, customization, regular seasonal and other cyclical changes, trading of new or significantly improved products are not considered innovations.

The process of innovating new solutions could fall into one of these areas:

- **Production:** This is related to processes, equipment and technology to enhance manufacturing or production processes. This includes computer software.
- **Delivery:** Delivery process innovations involve tools, techniques and software solutions to help in supply chain and delivery systems. This includes barcodes, tracking systems or shipping software.
- **Support Services:** Innovations in processes aren't limited to simply production or delivery, but also areas including purchasing, maintenance and accounting.

Innovation in Practice

Ford Motor Company

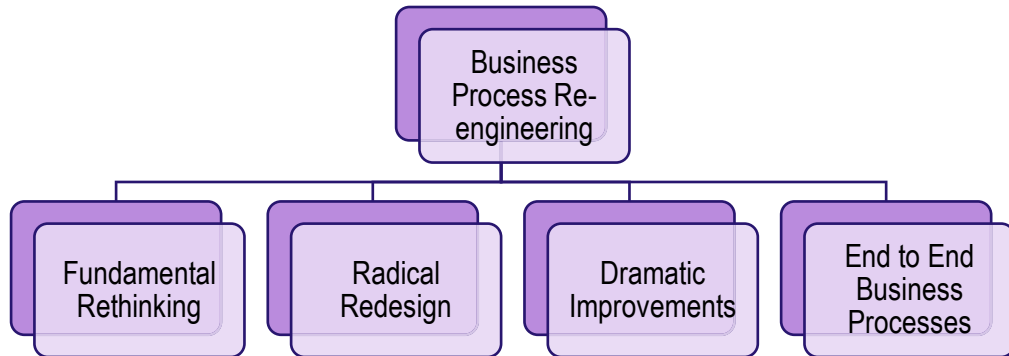
One of the most widely recognized automobile companies in the world is American-based multinational manufacturer, Ford Motor Company. Now more than 110 years old, the company was founded by Henry Ford and has succeeded in innovative designs and ideas for more than a century.

One of their most notable innovations came more than 100 years ago with the invention of the world's **first moving assembly line**. The process not only simplified vehicle assembly, but shortened the time necessary to produce a single vehicle from 12 hours to 90 minutes. That process innovation, creating an assembly line to speed up production, not only benefited the auto giant, but manufacturers of other consumer goods such as refrigerators and vacuum cleaners. It remains the typical mode of production for businesses today.



BUSINESS PROCESS REENGINEERING

In 1989, Michael Hammer, an ex-MIT computer professor turned consultant, published an article in the Harvard Business Review titled, "Reengineering Work: Don't Automate, Obliterate". Although several major companies had been experimenting with reengineering principles prior to that time, Hammer generally is credited with first using the term "reengineering". Hammer defines Business Process Reengineering (BPR) (or simply reengineering) as *"the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed."* Thus, the four key components of BPR are as follows:



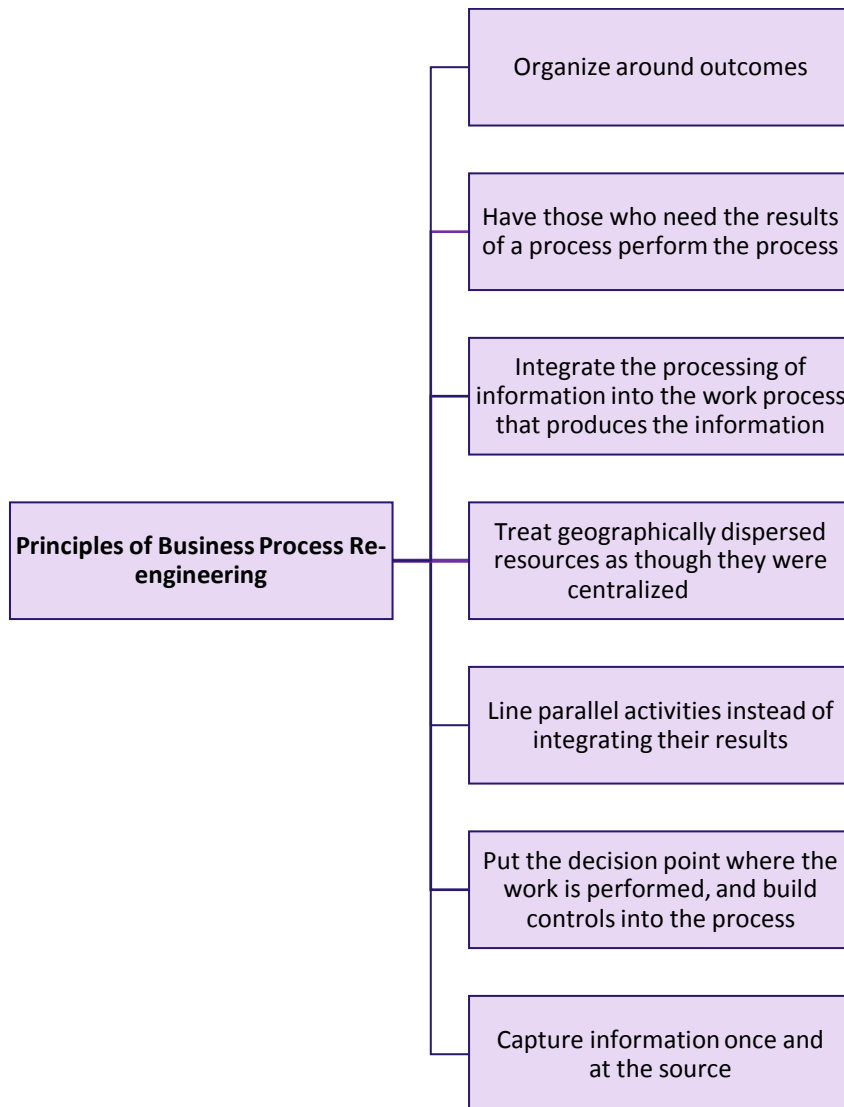
- **Fundamental rethinking** of business processes requires management to challenge the very basic assumptions under which it operates and to ask such rudimentary questions as “Why do we do what we do?” and “Why do we do it the way we do it?”
- **Radical redesign** relies on a fresh-start, clean-slate approach to examining an organization’s business processes. This approach focuses on answers to the question, “If we were a brand-new business, how would we operate our company?” The goal is to reinvent what is done and how it is done rather than to tinker with the present system by making marginal, incremental, superficial improvements to what’s already being done.
- **Achieving dramatic improvements** in performance measurements is related to the preceding two elements. The fundamental rethinking and radical redesign of business processes are aimed toward making quantum leaps in performance, however measured. BPR is not about improvement in quality, speed, and the like that is on the order of 10%. Improvement of that order of magnitude often can be accomplished with marginal, incremental changes to existing processes. Reengineering, on the other hand, has much loftier objectives. For example, the reengineering of Ford’s procurement process reduced the number of persons employed in the process by 75%.
- **Reengineering focuses on end-to-end business processes** rather than on the individual activities that comprise the processes. Michael Hammer contends that the fragmented business processes and bureaucratic, hierarchical organization structures evident in most businesses today have their origins in the Industrial Revolution, when specialization of labour and economies of scale were the promised keys to success. He argues that managers lose sight of their real objectives when processes are segmented into individual tasks, each task is assigned to a specialist, and elaborate mechanisms are established to track and control the performance of those tasks. Instead, BPR takes a holistic view of a business process as comprising a string of activities that cuts across traditional departmental or functional lines. BPR is concerned with the results of the process (i.e., with those activities that add value to the process). This cross-functional focus has been used for many years by manufacturing companies. Reengineering would apply that view to all business processes.

For example, consider the activities such as receiving a customer’s order, checking the customer’s credit, verifying inventory availability, accepting the order, picking the goods in the warehouse, and shipping the goods to the customer, as discrete activities. Reengineering

would change our emphasis by breaking down the walls among the separate functions and departments. Instead of order taking, picking, shipping, and so forth, the entire process of “order fulfilment” would be examined and would concentrate on those activities that *add value for the customer*. The customer is not concerned with the individual tasks that an organisation undertakes to fill an order nor is the customer concerned with how the company organizes itself to carry out those jobs. The customer is concerned only with getting the right goods, in the proper quantities, in satisfactory condition, and at the agreed-upon time and price.

Principles of BPR

The principles of successful BPR are as follows:



Organize around outcomes, not tasks

This principle argues that an organisation should have one person perform all the steps in a process; design the job around an objective or outcome rather than a single task. For example, at an electronics company a “customer service representative” takes a customer order, translates the order into internal codes for the ordered items’ components, requisitions, receives, and assembles the item, and delivers and installs the item. As a result, one person is responsible for getting the item to the customer and for answering customer questions during the process. Notice that while this eliminates many handoffs, numerous errors, delays, and misunderstandings, it also eliminates the traditional segregation of duties that organisations normally associate with the order fulfilment process.

Have those who need the results of a process perform the process

Departments in organizations are organized around specialized functions performed for customers for the output of other units. In some situations, reengineering can provide “customers” with more timely service and reduce the overhead needed to coordinate the activities of these units by having customers provide their own service. For example, in exchange for the promise of more timely repairs, an electronic equipment manufacturer asked its large customers to perform some of their own routine repairs and to carry the spare parts inventory required for their own machines. Now, customers make some repairs themselves using spare parts stored on site. The field service representatives, who had been making all repairs, answer customer calls and guide customers through a repair process using a diagnosis support system (an expert system). A computerized inventory management system monitors the spare parts inventories. Field service representatives are dispatched only for complex problems. The electronics manufacturer achieved better customer service and lower inventory carrying costs.

Integrate the processing of information into the work process that produces the information

At Ford Motor Company, the receiving department and the receiving system - produced and processed information about the goods received instead of sending it to accounts payable. The receiving system compared the goods received with the order and took appropriate action (send the goods back or create a payable). Notice again, the relaxing of segregation of duties. Management must evaluate and accept the risks associated with the increased opportunity for unauthorized or inaccurate transaction.

Treat geographically dispersed resources as though they were centralized

Decentralized resources typically provide better service to their customers at the expense of creating redundant operations and lost economies of scale. At Hewlett-Packard (HP), a major computer and peripherals manufacturer, 50 decentralized purchasing factions provided excellent responsiveness and service to the plants, but prevented HP from benefiting from quantity discounts. After reengineering, HP has a centralized purchasing function that creates and maintains a centralized database of vendors with whom they have negotiated contracts. Decentralized units can access the database to execute their own purchase orders.

Line parallel activities instead of integrating their results

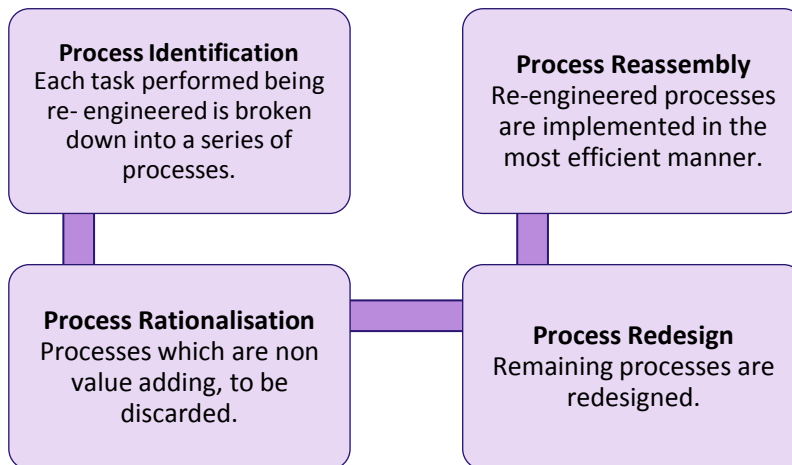
If parallel activities have been created, use communications networks, shared databases, and teleconferencing to coordinate activities that must eventually come together. For example, in the loan application process, decisions by one function that will affect the loan decision must be immediately communicated to other functions.

Put the decision point where the work is performed, and build controls into the process

Organisations often distinguish those who do the work from those who monitor and make decisions about the work. This is done under the assumption that those who do the work do not have the time, inclination, knowledge, or responsibility for monitoring and controlling what they do. Organisations can reduce non value-added management and flatten the organization structure if the organisations use information technology to capture and store data, and expert systems to supply knowledge, to enable people to make their own decisions. This changes the role of manager from controller and supervisor to supporter and facilitator. And, as organisations flatten, they can eliminate the middle managers who had been summarizing and reporting information to upper management. To compensate, executives must be directly lined to databases using executive information systems.

Capture information once and at the source

Collected and store data in online data-bases for all who need them. This principle is facilitated by information technology, such as telecommunications, networking, client/server architecture, EDI, image processing, relational database system, bare coding, intelligent workflow software.

Main Stage of BPR

Porter's Value Chain is commonly used in Business Process Re-engineering as a technique to *identify* and *analyse* processes that are of strategic significance to the organisation.

Case Scenario

ANI is a government-owned bank. The Bank has over 2,500 branches in country 'A' spread over all states/ union territories including specialized branches. These branches are controlled through 27 Zonal Offices and 4 NBG Offices. As a government owned bank it has usually been the first preference for customers while choosing a bank. In the last six years, the Government has permitted a number of foreign banks to operate within the country in order to solve the problem of foreign exchange shortage and open up foreign trade as an instrument to promote economic development. These foreign banks offer diverse range of services such as direct access to executive management, a single point of contact to coordinate all banking needs, appointment banking to save time, free online banking services 24/7, free unlimited ATM access etc. In contrast, ANI has very elementary information systems, covering only for internal transaction handling and accounting activities. Customers have to visit banks to carry out transactions like- checking bank balance, cash deposit and withdrawals, transferring money from one account to another in operational hours. Often customers complain about the amount of time as the employees and clerical staff of the bank can attend only few customers at a time. Customer service evaluation has never been undertaken by ANI. Other processes, new account applications, are complex, requiring completion of many documents formalities. Board of Directors were worried from growing popularity of new style banks. The Board of Directors of ANI has recently held meeting to discuss the shortfalls in its current services and the need to re-engineer the ANI's business processes.

Required

ADVISE how Business Process Reengineering (BPR) can be used to improve ANI's current processes.

Solution

BPR is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvement in critical contemporary measures of performance, such as cost, quality, service, and speed. In other words, BPR is concerned with the result of the process (i.e., with those activities that add value to the process). To implement BPR, firstly, each business process of ANI needs to be divided into a series of processes. Then each business process requires to be documented and analysed to find out whether it is essential, whether it provides support to other valuable processes and whether it is adding value. Any process which does not add value or does not provide essential support to the value adding activities must be removed. Those processes that remain require to be re-engineered/re-structured so that can be as efficient as possible. For ANI, new technology should be introduced to improve these processes. However, ANI must ensure that the statutory compliances regarding these processes are not undermined.

ANI is facing a hyper-competitive marketplace where customers expect a superior experience. BPR activities would help ANI in understanding those processes which ANI's customers value the most and remove those that are not valued. Foreign banks are offering diverse range of services such as direct access to executive management, a single point of contact to coordinate

all banking needs, appointment banking to save time, free online banking services 24/7, free unlimited ATM access etc. Clearly these are valuable business processes valued by the customer. ANI should incorporate all these facilities in their banking processes to enhance customer satisfaction and service level.

Opening of new accounts in ANI is complex processes since it requires multiple forms to be complied with. Through BPR, ANI would analyse the whole process and identify the need for only one form that contain all of the necessary customer information. Further, it is also possible to initiate opening of new account through the development of an online application form on ANI's website. Online entry would remove the possibility of forms being lost or incorrect, again enhancing customer satisfaction since customers need not to visit ANI's branch to open account. There should also be online processing authentications/ validations as to ensure that data fields are correctly filled by customers that would result in error reduction. This would also remove unnecessary staff activities in checking and re-processing forms.

It is likely that BPR may increase costs in short-term as investment in technology. However, this would also reduce substantial levels of manual activities and processes thereby providing speedy services to customers. In long term, this would result in high levels of efficiency, profitability and better levels of customer satisfaction and retention.

BPR in Practice

Ford Motor Company

Spurred by the depression in the American automotive industry in the early 1980s, Ford's top management decided to examine all of its departments, looking for ways to cut costs. Its North American accounts payable processing alone employed some 500 persons. Management felt that by streamlining the process and installing a new computer system, accounts payable personnel could be reduced by 20%. Although the prospect of reducing accounts payable staff to 400 looked impressive, Ford's management re-examined that target when it learned that Mazda, a Japanese automaker, had only 5 people for the accounts payable function. Even after adjusting for the difference in Mazda's size, Ford concluded that it should aim for a reduction in force of several hundred rather than the 100 it originally planned. Note the dramatic performance improvement it set as the goal of this reengineering project. Under the old system, the accounts payable department had to match 14 different data items among the receiving document, purchase order, and vendor invoice before it could make a payment to the vendor. Since mismatches were numerous, the department spends most of its time resolving the discrepancies. Payments were delayed and copious documents were generated. A "conventional" solution to these problems might have been to automate the investigation process to make it more efficient. But Ford opted for a better, more radical solution-namely, to prevent the mismatches from ever occurring. Instead of an accounts payable department, Ford's has a new, reengineered procurement process. Emphasis on the words procurement and process shifts focus from the individual activities that comprised the old system to the desired outcome of those activities the timely procurement of the correct goods and payment therefore. The new system represents a radical departure from the

old. There are no vendor invoices in the new system; Ford has asked its vendors not to send invoices. When the purchasing department issues a purchase order (PO), it enters the order into an online database. No copies of the order are sent to anyone other than to the vendor. When the goods arrive at the receiving dock, a receiving clerk checks the goods against the database to see that they correspond to an open purchase order. If so, the clerk accepts the shipment and enters the receipt into the computer system. If there are discrepancies between the goods received and the purchase order record per the database, the goods are returned to the vendor. Once the receipt has been entered into the system, the computer prepares the check, which accounts payable sends to the vendor.

Ford has achieved a 75% reduction in payables processing personnel, rather than the 20% reduction it had envisioned with a more conventional solution. Furthermore, inventory control has been simplified and financial information is more accurate because there are no discrepancies between the financial record and the physical record of the goods received. Obviously, to implement the new system, Ford has had to work closely with its vendors and its employees to help them adapt to this drastic change in their trading partnerships. All parties must now recognize that the purchase order is the linchpin of the system. Because a vendor invoice does not exist, the PO must contain all the information about costs, terms, and the like needed to make payment to the vendor. Further, since variances between the PO and goods received are not tolerated, vendors must accept the fact that if they deviate from the PO, they will have the goods returned to them.

Difference Between Two Approaches (BPR vs PI)

Bike Manufacturing Process

Bikes are assembled through passing them along a continuous moving band of metal & rubber and adding parts to each one in a prearranged order to arrive at the finished product. This process can be upgraded in terms of efficiency by using automated machines to do some of the repetitive actions. In this manner, the process is being redesigned to include enhanced automated system to make it more efficient. In other words, Business Process Re-engineering is being used to improve the existing process. But the process itself *could be redesigned from scratch*. For example, the bike could be manufactured by giving all the parts to a team of specialist and asking them to work together to make it. This will mean creating *completely new processes*, which may or may not be more efficient than those of the existing system. But the “process vision” of providing better satisfaction to team of workers from the production process itself may supersede the efficiency issues. In this example, Process Innovation results in entirely new process to manufacture the bike, even if we haven’t defined them – it’s up to the workers to decide.



SUMMARY

- Lean System is an organized method for waste minimization without sacrificing productivity within a manufacturing system. Lean implementation emphasizes the importance of optimizing work flow through strategic operational procedures while minimizing waste and being adaptable
- Just in Time - System whose objective is to produce or to procure products or components as they are required by a customer or for use, rather than for stock. just-in-time system Pull system, which responds to demand, in contrast to a push system, in which stocks act as buffers between the different elements of the system such as purchasing, production and sales.

Features of JIT

Material – handling cost are reduced.

Labour idle time gets reduced.

JIT creates urgency for eliminating defects as quickly as possible.

The company can respond to customer demand faster.

Carefully selected suppliers capable of delivering high quality materials in a timely manner directly at the shop – floor, reducing the material receipt time.

Pre- requisites of JIT - Low variety of goods, Vendor reliability, Good communication, Demand stability, TQM, Defect free materials, Preventive maintenance.

Impact of JIT System – Wastes costs like unnecessary levels of obsolete inventory, defective products, rework, etc, overhead costs like material handling, facilities, and quality inspection costs of staff, equipment, fixed assets, facilities, and rent associated with the warehouse etc. get eliminated and When a company achieves a higher level of product quality, along with ability to deliver products on the dates required, customers may be willing to pay a premium.

Performance Measurement in JIT –

- a) Machine utilization measurements can be discarded under JIT environment.
- b) No piece rate tracking for each employee.
- c) No direct labour efficiency tracking.
- d) Set up time reduction.
- e) Customer complaints should be investigated immediately.
- f) Scrap generation is reduced.
- g) Track of full cost of quality which comprises defect control costs, failure costs, and the cost of lost sales.
- h) Highest possible degree of customer service.

- i) Continuous improvement through new ideas.

Backflushing in a JIT System

- a) Backflushing requires no data entry of any kind until a finished product is completed. At that time the total amount finished is entered into the computer system, which multiplies it by all the components listed in the bill of materials for each item produced. This yields a lengthy list of components that should have been used in the production process and which are subtracted from the beginning inventory balance to arrive at the amount of inventory that should now be left on hand.
 - b) Problems with backflushing – Incorrect production reporting, Incorrect scrap reporting, Impossible lot tracing, Inaccurate inventory records.
- Kaizan Costing –
 - a) Kaizan means continual improvement. The kaizen strategy aims to involve workers from multiple functions and levels in the organization in working together to address a problem or improve a particular process.
 - b) Kaizan costing principals - gradual improvements in the existing situation, at an acceptable cost, collective decision making and application of knowledge, no limits to the level of improvements that can be implemented, setting standards and then continually improving these standards to achieve long-term sustainable improvements, focus on eliminating waste, improving systems, and improving productivity, involves all employees and all areas of the business.
 - 5 S's - It explains how a work space should be organized for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items, and sustaining the new order. 5 S include Sort, Set in Order, Shine, Standardise, Sustain.
 - Total Productive Maintenance - Total Productive Maintenance (TPM) is a system of maintaining and improving the integrity of production and quality systems. TPM helps in keeping all equipment in top working condition so as to avoid breakdowns and delays in manufacturing processes.
 - a) TPM performance is measured by Overall Equipment Effectiveness (OEE) measure which needs to quantify losses due to equipment failure, set-ups, idle time, stoppages, reduction in speed, reduction in yield, quality defects and rework.
 - b) $\text{Performance} \times \text{Availability} \times \text{Quality} = \text{OEE} \%$
 - Cellular Manufacturing – In the assembly line multiple cells are used. Each cell comprises of one or more machines which accomplish a certain task. The product moves from one cell to the next, each station completing part of the manufacturing process. U-shaped design is given to these cells because this allows for the supervisor to move less and have the ability to more readily watch over the entire process.
 - a) Goals of cellular manufacturing - move quickly, make wide variety of similar products, very less wastes.

- b) Advantages – Flexibility in operations, changes easy to make, variety of product scaling, minor changes can be easily and quickly implemented, conducted by logic so reduces flow time, flow distance, floor space, inventory, handling, scheduling transactions, and scrap and rework, production and quality controls facilitated, improves group cohesiveness among employees.
 - c) Limitations – Decrease in production flexibility, difficulty in realignment of cells in case of decrease in demand, changes in flow may be very costly.
- Six Sigma - It is quality improvement technique whose objective to eliminate defects in any aspect that affects customer satisfaction. The premise of Six Sigma is that by measuring defects in a process, a company can develop ways to eliminate them and practically achieve “zero defects”. The standard measure of Six Sigma is 34 errors per million.
 - Process Innovation - Process innovation means the implementation of a new or significantly improved production or delivery method (including significant changes in techniques, equipment and/ or software).
 - Business Process Reengineering - Business Process Reengineering (BPR) is “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed.”
 - a) Key components of BPR - Fundamental rethinking of business processes, Radical redesign if we had to start the business afresh, Achieving dramatic improvements in performance measurements, Reengineering focuses on end-to-end business processes rather than on the individual activities that comprise the processes.
 - b) Principles of BPR - Organize around outcomes, not tasks, are those who need the results of a process perform the process, Integrate the processing of information into the work process that produces the information, treat geographically dispersed resources as though they were centralized, Line parallel activities instead of integrating their results, Put the decision point where the work is performed, and build controls into the process, Capture information once and at the source.



TEST YOUR KNOWLEDGE

Just in Time

1. A manufacturer is considering implementing Just in time inventory system for some of its raw material purchases. As per the current inventory policy, raw materials required for 1 month's production and finished goods equivalent to the level of 1 week's production are kept in stock. This is done to ensure that the company can cater to sudden spurt in consumers' demand. However, the carrying cost of inventory has been increasing recently. Hence, the consideration to move to a more robust just in time purchasing system that can reduce the inventory carrying cost. Details relevant to raw material inventory are given below:

- Average inventory of raw material held by the company throughout the year is ₹1 crore. Procurement of raw material for the year is ₹12 crore. By moving to just in time procurement system, the company aims at eliminating holding this stock completely in its warehouse. Instead, suppliers of these materials are ready to provide the goods as per its production requirements on an immediate basis. Suppliers will now be responsible for quality check of raw material such that the raw material can be used in the assembly line as soon as it is delivered at the company's factory shop floor.
- Increased quality check service done by the suppliers as well as to compensate them for the risk of holding the inventory to provide just in time service, the company is willing to pay a higher price to procure raw material. Therefore, procurement cost will increase by 30%, total procurement cost will be ₹15.6 crore per year. Consequently, quality check and material handling cost for the company would reduce by ₹1 crore per year. Similarly, insurance cost on raw material inventory of ₹20 lakh per year need not be incurred any longer.
- Raw material is stored in a warehouse that costs the company rent of ₹3 crore per annum. On changing to Just in time procurement, this warehouse space would no longer be required.
- Production is 150,000 per year. The company plans to maintain its finished goods inventory equivalent to 1 week's production. Despite this, in order to have a complete cost benefit analysis, the management is also factoring the possibility of production stoppages due to unavailability of raw material from the suppliers. This could happen due to of delay in delivery or non-conformance of goods to the standard required. Labor works in one 8-hour shift per day and will remain idle if there is no material to work on. Due to stoppage of production for the above reason, it is possible to have stockout of 3,000 units in a year. Stockout represents lost sales opportunity due to unavailability of finished goods, the customer walks away without purchasing any product from the company. Therefore, in order to reduce this opportunity cost and to make up for the lost production hours, labor can work overtime that would cost the company ₹10 lakh per annum. This is the maximum capacity in terms of hours that the labor can work. With this overtime, stockout can reduce to 2,000 units.
- Currently, sale price of phone is ₹5,000 per unit, variable production cost is ₹2,000 per unit while variable selling, general and administration (SG&A) cost is ₹750 per unit. Raw material procurement cost is currently ₹800 per unit, that will increase by 30% to ₹1,040 per unit under Just in time inventory system.
- On an average, the long-term return on investment for the company is 15% per annum.

Required

- (i) CALCULATE the benefit or loss if the company decides to move from current system to Just in Time procurement system.

- (ii) RECOMMEND factors that the management needs to consider before implementing the just in time procurement system.

Total Productive Maintenance (TPM)

2. SSK Pharmaceuticals Ltd. is producing medication products (pills, balms etc.) and can be called high volume based production environment. There are several different automated production machines located in the plant, through which production of medicines is accomplished and fulfilled the demands. Plant operates in double shift a day each consisting of 8 hours with 30 minutes' lunch break and tea break of 15 minutes. Following data pertains to automated machine 'X-78'.

X-78

14 February 2019, Wednesday

Breakdown, repair and start up time	68 minutes
Standard cycle time	2.5 minutes per tablet
Quality loss due to scrap, rework, and rejection	50 tablets
Total quantity produced	280 tablets

Required

COMMENT on OEE.

3. Hindustan Ltd. supplies the following information relating to a vital equipment used in its production activity for April, 2019:

Total time worked during the month	210 hrs.
Total production during the month	2,800 units
No. of units accepted out of total production	2,520 units
Standard time for actual production of the month	180 hrs.
Time lost during the month	28 hrs.

Required

- (i) STATE an appropriate approach to measure the total productive maintenance performance of an equipment.
- (ii) Quantify the total productive maintenance performance of the above-mentioned equipment by using the approach stated in (i) above.
- (iii) COMMENT on the effectiveness of maintenance of the equipment.

Business Process Re-engineering (BPR)

4. History

ANA is one of Country 'I's top footwear companies and other equipment. Since its foundation in 1988, ANA has been one of the all-inclusive footwear brand that is committed to nurturing the youth across the world through sports to contribute to society. Over more than three decades, the company inherits its values and provides own products while capturing the changes in the social environment. It's state-of-the-art production facilities are located strategically across the Country 'I' and produces all kinds of footwear. ANA is best known for its high ethical standards towards its workers, suppliers and the environment and voluntarily publish CSR report every year.

Organizational Structure and Footwear Market

ANA is organized into conventional functional departments such as procurement on order basis, sales, and finance, most of which have their non-reliable excel sheet-based systems for planning and reporting. Consequently, it often fails to generate accurate, timely and consistent information to monitor its own performance, thus, company faces failures in achieving the performance and delivery targets set by its retail customers.

In Country 'I', footwear market is competitive and seasonal. Retailers, who are ANA's customers, for footwear, they have two main demands, they want –

- (i) footwear at lower prices to pass it on to consumers.
- (ii) suppliers to meet performance and delivery targets relating to lead times and quality.

In order to comply with the retailer's demands, ANA's competitors have discontinued all their own manufacturing facilities and outsourced all production to suppliers, who have much larger production lines and lower costs. To reduce the shipment cost over long distances, competitors have invested in advanced procurement software to consolidate orders so that each 40-foot shipping container gets fully loaded. Purchase invoice processing is also automated via the integration of information systems into the supplier's software.

Proposal of Outsourcing

In order to mitigate costs, it has been proposed to outsource the manufacture of footwear, to a Chinese Supplier 3,750 km away. A comparison of the average cost of manufacturing and the cost of outsourcing footwear is given below–

Particulars	Manufacturing	Outsourcing
Average manufacturing cost <i>per pair</i>	BND 625	---
Purchase cost <i>per pair</i>	---	CNY 28

Notes-

1. Country 'I's home currency is the BND.
2. Exchange Rate 1CNY = 18 BND.

3. In addition to the purchase cost from the supplier, ANA will be subject to pay for shipping costs at the rate of BND 40,000 for each large, standard sized shipping container, regardless of the number of units in it. Each container contains 5,000 pairs when fully loaded.
4. Custom tariffs are expected to change soon, footwear imports into ANI's home country might be subject to 10% basic custom duty (plus 10% social welfare surcharge on duty) on the assessable value of imports excluding shipping costs.

Therefore, to implement the proposal, restructuring of functional departments into multi-disciplinary teams are needed to serve major buyer accounts. Each team is required to perform all activities, related to the buyer account management from order taking (sales order) to procurement to arranging shipping and after sales services. Team members dealing with buyers will work in ANA's corporate office, while those like QC etc. managing quality and supplier audits, will work at the manufacturing site of Chinese Supplier. Teams will be given greater independence to selling prices to reflect market conditions or setting a price based on the value of the product in the perception of the customer. Many support staff will work as helper roles, or be offered new jobs opportunities overseas after the restructuring.

Expert Advise

Prof. WD, Performance Management Consultant has advised ANA that the proposal has features of re-engineered processes and can be defined as business process re-engineering (BPR). Prof. advised, for evaluating the proposal, ANA should consider software development for full front-end order entry, purchasing, and inventory management solution which may be required along with ethical aspect of the proposed changes.

Required

- (i) ADVISE on information system which would be required for the reengineering.
- (ii) ASSESS the likely impact of reengineering on the ANA's high ethical standards and accordingly on business performance.
- (iii) EVALUATE how the BPR proposal can improve ANA's performance in relation to retail customers.

ANSWERS/ SOLUTIONS

1. (i) Implementing Just in time procurement system will benefit the company by ₹11,27,000 per year as explained below:

Therefore,

Particulars	Current Purchasing Policy (₹)	JIT Procurement System (₹)
Raw material procurement cost per year	12,00,00,000	15,60,00,000

Quality check and material handling cost (<i>No longer required in JIT</i>)	1,00,00,000	---
Insurance Cost on raw material inventory (<i>No longer required in JIT</i>)	20,00,000	---
Warehouse rental for storing raw material (<i>No longer required in JIT</i>)	3,00,00,000	---
Overtime Charges under JIT to reduce Stockouts (note1)	---	10,00,000
Stockout Cost (note 2)	---	40,20,000
Total Relevant Cost	16,20,00,000	160,020,000

Therefore, moving to just in time procurement system results in savings of ₹980,000 per year for the company. If reinvested, long term return on investment for the company at 15% would yield a return of ₹147,000 per year. Therefore, total benefit for the company would be ₹11,27,000 per year.

Note 1: Should overtime cost be incurred to reduce Stockouts?

Contribution per unit = Sale price - Variable production cost - Variable selling, distribution cost per unit; Variable production cost under the just in time system = ₹2,000 + ₹(1,040-800) = ₹2,240 per unit; Contribution per unit = ₹5,000 - ₹2,240 = ₹2,760 per unit = ₹2,010 per unit.

Overtime cost can reduce stockouts from 3,000 units to 2,000 units that is customers' demand of 1,000 units more can be met.

Contribution earned from selling these 1,000 units = 1,000 × ₹2,010 per unit = ₹20,10,000.

Therefore, the contribution earned of ₹20,10,000 is more than the related overtime cost of ₹10,00,000. Therefore, it is profitable to incur the overtime cost.

Note 2: Stockout Costs

Out of the total shortfall of 3,000 units, by spending on overtime 1,000 units of demand can be met. Therefore, actual stockout units is only 2,000 units. As explained above, contribution per unit is ₹2,010 per unit. Therefore, stockout cost = 2,000 units × ₹2,010 per unit = ₹40,20,000.

- (ii) The company plans to eliminate its raw material inventory altogether. Raw material will be delivered as per production schedule directly at the factory shop floor, from whence production will begin. The management should therefore carefully consider the following points:
- The entire production process has to be detailed and integrated sequentially. This is essential to know because it should be known in advance when in the sub-assembly process is each raw material is required and in what quantity.

- (b) Since production is dependent on delivery and quality of raw material, heavy reliance is being placed on suppliers. They should be able to guarantee timely delivery of raw material of the appropriate quality. The company is paying a premium of 30% of original cost, that is ₹240 per unit (₹1,040 - ₹800 per unit) in order to ensure the same. Each unit gives a contribution of ₹ 2,010 per unit, which is 40.2% of the sale price per unit. Lost sales opportunities due to unavailability of raw material or non-conformance of the material can result in substantial losses to the company. While, portion of this has been factored while doing the cost benefit analysis of implementing Just-in-time systems, it needs careful consideration and monitoring even after implementation. Therefore, to hedge its loss, the management and suppliers should agree on penalties or costs the supplier should incur should there be any delay or non-conformance in quality of materials beyond certain thresholds.
- (c) Accurate prediction of sales trends is important to determine the production schedule and finished goods planning.
- (d) Continuous monitoring of the system even after implementation is essential to ensure smooth operations. Management commitment and leadership support is essential for its successful implementation and working.

2. Calculation of Loss of Time Per Shift

	Mins.
Lunch Break	30
Tea Break	15
Breakdown, Repair, and Start-up Time (68 mins / 2 Shift)	34
Total Time Loss Per Shift	79

$$\text{Availability Ratio per shift} = \left\{ \frac{480 \text{ mins.} - 79 \text{ mins.}}{480 \text{ mins.}} \right\} \times 100\%$$

$$= 83.54 \%$$

$$\text{Actual Production} = 140 \text{ tablets per shift}$$

$$\text{Standard time} = 2.5 \text{ minutes}$$

$$\text{Standard Time Required} = 140 \text{ units} \times 2.5 \text{ minutes}$$

$$= 350 \text{ minutes}$$

$$\text{Actual Time Taken} = 480 \text{ mins.} - 79 \text{ mins.}$$

$$= 401 \text{ minutes}$$

$$\text{Performance Ratio} = \left\{ \frac{350 \text{ mins.}}{401 \text{ mins.}} \right\} \times 100\%$$

$$\begin{aligned}
 &= 87.28\% \\
 \text{Quality Ratio} &= \left\{ \frac{140 \text{ tab.} - 25 \text{ tab.}}{140 \text{ tab.}} \right\} \times 100\% \\
 &= 82.14\% \\
 \text{Thus, OEE} &= 0.8354 \times 0.8728 \times 0.8214 \\
 &= 59.89\%
 \end{aligned}$$

Since OEE of SSK Pharmaceuticals Ltd. is lesser than 85 % i.e. World Class Performance Level, Company is advised to improve its each ratio i.e. availability ratio, performance ratio and quality ratio by collecting information related to all downtime and losses on machines, analyzing such information through graphs and charts, making improvement decisions thereon like autonomous maintenance, preventive maintenance, reduction in set up time etc. and implementing the same.

3. (i) The most important approach to the measurement of TPM performance is known as Overall Equipment Effectiveness (OEE) measure. The calculation of OEE measure requires the identification of “six big losses”
1. Equipment Failure/ Breakdown
 2. Set-up/ Adjustments
 3. Idling and Minor Stoppages
 4. Reduced Speed
 5. Reduced Yield and
 6. Quality Defects and Rework

The first two losses refer to time losses and are used to calculate the availability of equipment. The third and fourth losses are speed losses that determine performance efficiency of equipment. The last two losses are regarded as quality losses.

$$\text{Performance} \times \text{Availability} \times \text{Quality} = \text{OEE} \%$$

OEE may be applied to any individual assets or to a process. It is unlikely that any manufacturing process can run at 100% OEE.

$$\begin{aligned}
 \text{(ii) Availability Ratio per shift} &= \left\{ \frac{210 \text{ hrs.}}{210 \text{ hrs.} + 28 \text{ hrs.}} \right\} \times 100\% \\
 &= 88.24 \% \\
 \text{Performance Ratio} &= \left\{ \frac{180 \text{ hrs.}}{210 \text{ hrs.}} \right\} \times 100\% \\
 &= 85.71\%
 \end{aligned}$$

$$\text{Quality Ratio} = \left\{ \frac{2,520 \text{ units}}{2,800 \text{ units}} \right\} \times 100\%$$

$$= 90.00\%$$

$$\text{Thus, OEE} = 0.8824 \times 0.8571 \times 0.90$$

$$= 68.06\%$$



This question has been solved by considering “**Time Available equals to Total Time Worked plus Time Lost**”.

(iii) Comment

World Class OEE is 85% or greater, Hindustan Ltd.'s OEE is somewhere around 68%. It just means that company got some opportunities for improvement. Hindustan Ltd. may improve OEE by collecting information related to all downtime and losses on equipment, analyzing such information through graphs and charts, making improvement decisions thereon like autonomous maintenance, preventive maintenance, reduction in set up time etc. and implementing the same.

4. (i) Advise on Information System

Combining several jobs into one, permitting workers to make more decision themselves, defining different versions of processes for simple cases vs complex ones, minimizing situations when one person check someone else's work, and reorganizing jobs to give individuals more understanding and more responsibility are characteristics of re-engineered processes.

In ANA, outlays can be saved by rearranging staff into multidisciplinary teams, for example, reducing number of excess staff at different stages – cutting, preparation, finish etc. These savings can be utilized in additional costs such as investment in new information systems. Hammer and Champy stress the use of information technology as a catalyst for major changes. BPR organizes work around customer processes rather than functional hierarchies.

Presently, ANA's departments have their own excel sheet-based systems for planning and reporting which is unreliable and inconsistent. They are inadequate to provide the accurate, timely and consistent data which ANA needs to meet its own performance and delivery targets. There must a shared database that should be accessible by all parts of the functional teams. This should have real time updation, so that employees in different time zones can use updated data. The database should include financial data and non-financial data, like cost information, data related to lead times and quality. Information systems must be featured with all required reports like performance report, budget report etc.

In addition, ANA is required to invest in special system as advised by Prof. WD for full front-end order entry, purchasing, and inventory management solution to minimize shipping costs by ensuring that the shipping containers get fully loaded and to integrate with supplier's information systems to automate purchase invoicing.

Overall, ANA must analyze that whether the benefits due to information technology are worthy.

(ii) Assessment of Likely Impact of Re-engineering on Ethical Standards

Workers

ANA is famous for its high ethical standards towards workers and staff. Because of adopting BPR proposal, manufacturing staff are likely to be unemployed. Competitors, have already shutdown their factories, these workers may not be able to find analogous jobs.

Employees who continue in work may become disappointed if they think the application of BPR to all products. This may reduce productivity, increase staff turnover or difficulties in recruiting new staff. In addition, they may also be demotivated if they are appointed in unfamiliar roles, or may not be willing to learn new skills.

Some of staff members may be motivated by the opportunity to perform new types of work, learn new skills or work outside India. This maybe enhance their individual performance.

Suppliers

Any association with non-ethical practices, for example, if the Chinese supplier is indulged in using non-acceptable working practices, could seriously spoil ANA's reputation for high ethical standards. This could undermine financial performance because customers may not buy its products, or possible investors might refuse from providing capital. Staff members located at the manufacturing site is responsible for supplier audits, which may assist to mitigate this risk.

Environment

ANA should consider the environmental impact of importing goods from long distances. The environmental related credentials of the Chinese Supplier are not known. Since, ANA voluntarily publishes a corporate sustainability report, any distortion in its performance on environmental issues might undermine the financial performance.

(iii) Evaluation of BPR Proposal in relation to Retailer's Demand

Lower Prices

In order to sell footwear at lower prices, there is proposal to reduce costs by outsourcing production to supplier. The current average production cost of manufacturing is BND 625.00 per unit. The cost of purchase from an external supplier is BND 512, which is BND 504 (CNY18 × BND28) purchase cost, plus BND 8 (BND 40,000/ 5,000) shipping

cost. This 18.08% (113/ 625) saving is a substantial improvement in financial performance, but not a dramatic one. It may be noted that BPR is a methodology that should be applied only when radical or dramatic change is required. Further, exchange rate movements may also slash the cost saving significantly. In the near future, expected changes to international trade tariffs will increase the unit cost to CNY30.83 (CNY28.00 × 110.10%) i.e. 554.94 in BND and reduce the cost saving to just 11.21% (70.06/ 625).

Meeting Performance Targets

Lead times

Current lead times for customer orders are not ascertainable. Since the proposed Chinese Supplier is 3,750 km away, consignment will take several weeks to be imported by sea. This may increase lead times substantially, although may be set off by faster production times in supplier's plant. As ANA's sales are seasonal, retailers may order in advance, decreasing the long lead times. In order to decrease shipping costs, shipping containers must be full, meaning that deliveries must be in larger quantities.

Quality

ANA is already known for manufacturing high quality footwears. The quality of the new supplier's footwear needs to be checked. Any distortion in the quality of footwear will deteriorate its reputation and decrease long-term business performance since only few customers would order. Quality standards checking is more difficult while using outside suppliers, especially at long distance, than manufacturing in ANA's own factory. In BPR, work is done where it makes most sense to do so. In this aspect, having employees responsible for quality checking and supplier audits (working at the manufacturing site, abroad) will assist ANA in sustaining the best supplier relationship management.



COST MANAGEMENT TECHNIQUES



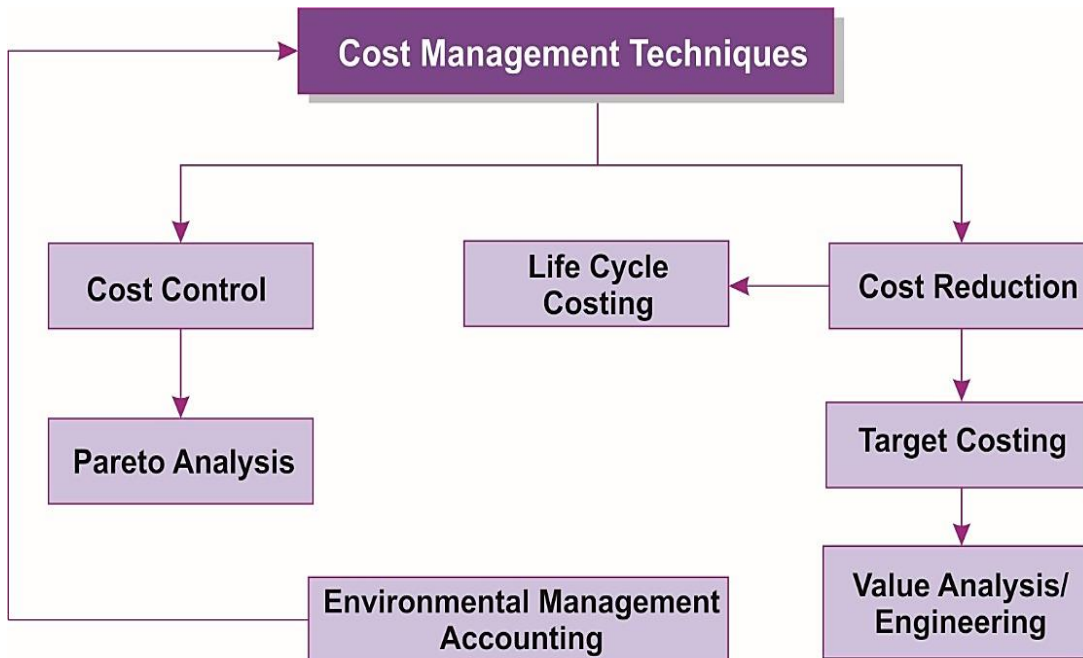
LEARNING OUTCOMES

After studying this chapter, you will be able to:

- ❑ **Apply** Cost Management Techniques
- ❑ **Derive** a Life Cycle Cost in manufacturing and service industries
- ❑ **Identify** the Costs involved at different stages of the life-cycle
- ❑ **Derive and Evaluate** Target Cost in manufacturing and service industries
- ❑ **Discuss** the issues business face in the management of Environmental Costs



CHAPTER OVERVIEW



COST CONTROL/ WASTE CONTROL AND COST REDUCTION

Cost Control implies regulation of cost by executive action. For this purpose, the executives are provided with some yard stick such as standards or budgets with which the actual costs and performances are compared to ascertain the degree of achievement made. Therefore, Cost Control involves continuous comparisons of actual with the standards or budgets to regulate the former.

Cost Control is possible only when an organization has an effective Cost Accounting System to provide relevant information. Costs should be categorized into controllable and non-controllable. The organizations is divided into responsibility centers. Every executive is made responsible for the performance of the center under his control.

Amongst the techniques used for Cost Control, the most two popular are Standard Costing and Budgetary Control.

Cost Reduction is the achievement of real and permanent reduction in unit cost of products manufactured. It, therefore, continuously attempts to achieve genuine savings in cost of production distributing, selling and administration. It does not accept a standard or budget. It rather challenges the standards/budgets continuously to make improvement in them. It attempts to excavate, the potential savings buried in the standards by continuous and planned efforts.

Cost Control relax that dynamic approach, it usually dealt with variances leaving the standards intact.

Cost Reduction	Cost Control
Cost Reduction is the achievement of real and permanent reduction in unit cost of products manufactured.	Cost Control involves a comparison of actual with the standards or budgets, to regulate the actual costs.
Realistic savings in cost.	There could be temporary savings in cost.
Product's Utility, Quality and Characteristics are retained.	Quality Maintenance is not a guarantee.
It is not concerned with maintenance of performance according to standards	The process involves setting up a target, investing variances and taking remedial measures to correct them.
Continuous process of critical examination includes analysis and challenge of standards.	Control is achieved through compliance with standards. Standards by themselves are not examined.
Fully dynamic approach.	Less dynamic than Cost Reduction.
Universally applicable to all areas of business. Does not depend upon standards, though target amounts may be set.	Limited applicability to those items of cost for which standards can be set.
Emphasis here is partly on present costs and largely on future costs.	Emphasis on present and past behaviour of costs.
The function of Cost Reduction is to find out substitute ways and new means like waste reduction, expense reduction and increased production	Cost Control does competitive analysis of actual results with established standards.
Cost reduction is a corrective measure.	Cost Control is a preventive measure.

Scope of Cost Reduction

Some of the important area where maximum efforts of the organization must concentrate to reduce costs are discusses as under:

Product Design

Cost reduction starts with the design of the product. Product design being first step in manufacturing of a product, the impact of any economy or cost reduction effected their stage will be felt throughout the manufacturing life of the product. Design is therefore the most important field where cost reduction may be attempted. Efficient designing for a new product or improving the design for an existing product reduces cost in the following manner:

- Cheaper substitute, higher yield and less quantity and varieties of materials, cause reduction in cost.
- Reduced time of operation and increased productivity reduce cost.
- Standardization and simplification in variety increases productivity and reduces costs.

Organisation

It is not possible to measure the extent of cost reduction resulting from an improvement in organisation nevertheless, economies are bound to be achieved if the following considerations are looked into:

- Definition of each function and responsibility.
- Proper assignment of task and delegation of responsibility to avoid overlapping
- A suitable channel of communication between various management levels.
- Co-operation and closed relationship between the various executives.
- Removal of doubts and fiction.
- Encouragement to employees for cost reduction suggestion.

Factory Lay Out Equipment

A cost reduction programme should study the factory layout and the utilisation of the existing equipment to determine whether there is any scope of cost reduction by elimination of wastage of men, materials and maximum utilisation of the facilities available.

The necessity for replacement of Plants, introduction of new techniques or expansion of facilities should be considered and various alternatives explored with a view to reducing costs.

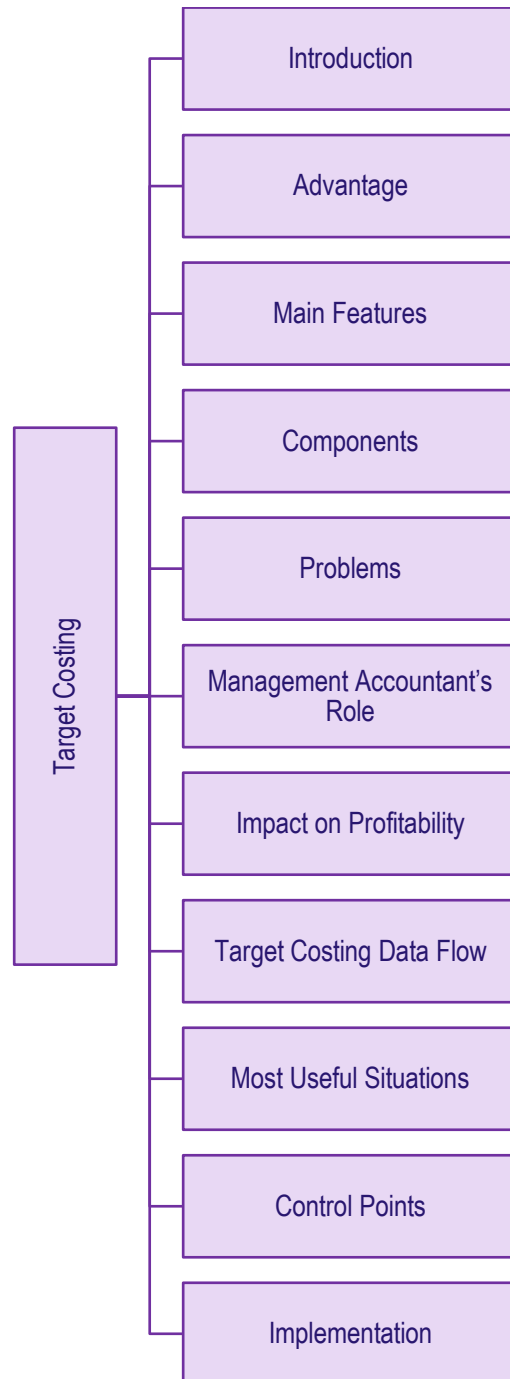
Production Plan Programme and Method

Production control ensures proper planning of work by installing an efficient procedure and programme ordering correct machine and proper utilisation of materials, manpower and resources so that there is no waste of time and money due to wait for components, men, material etc. An efficient cost reduction programme should examine the following points relating to production control.

- Whether wastage of manpower and material is kept to the minimum.
- Whether there is any scope for reducing idle capacity.
- Whether the procedures for the control of stores and maintenance services are efficient.
- Whether labour wastage may be reduced and productivity increased by eliminating faulty production method, plant layout and designs or introducing incentive schemes.
- Whether there is scope for reduction of overhead, whether a budgetary control system is in operation to ensure the control over overhead costs.

It may be extended to administrative, selling and distribution methods, personnel management, purchase and material control, financial management and other services.

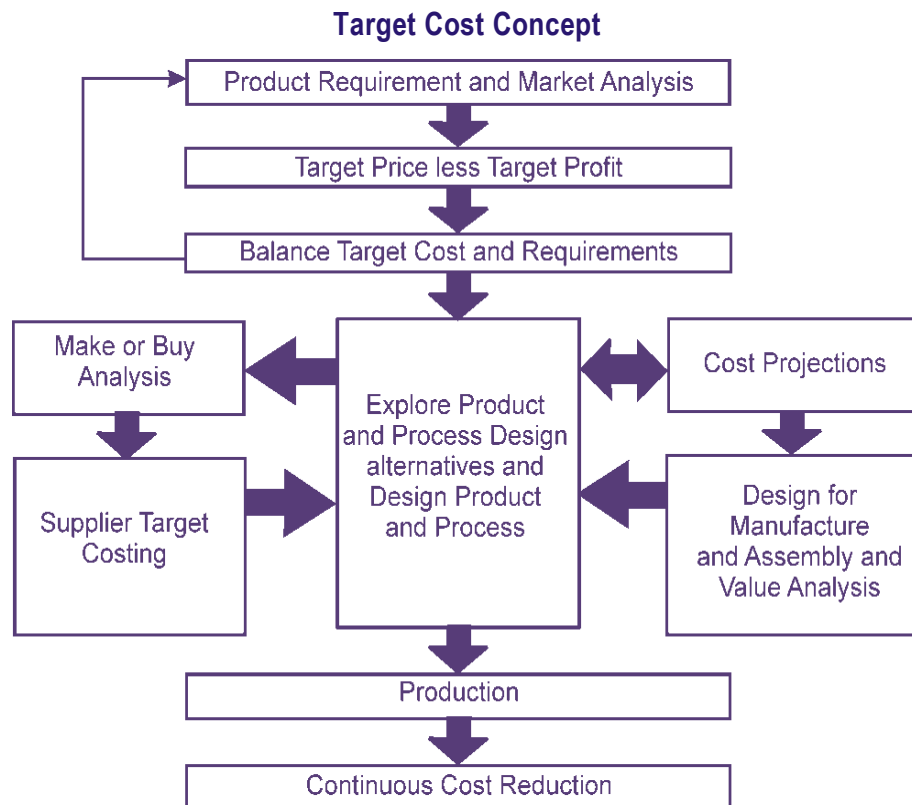
Tools and Techniques for Cost Reduction are Value Analysis, Inventory Management (Just in Time etc.), Business Process Reengineering (BPR), Target Costing, Kaizen Costing etc.

 TARGET COSTING

Target costing has been described as a process that occurs in a competitive environment, in which cost minimization is an important component of profitability. This newer approach of *product costing may take into account initial design and engineering costs, as well as manufacturing costs, plus the costs of distribution, sales and services.*

It can be defined as **“a structured approach to determining the cost at which a proposed product with specified functionality and quality must be produced, to generate a desired level of profitability at its anticipated selling price”**.

A critical aspect of this definition is that it emphasizes that target costing is much more than a management accounting technique. Rather, it is an important part of a comprehensive management process aimed at helping an organization to survive in an increasingly competitive environment. In this sense the term “target costing” is a misnomer: it is not a product costing system, but rather a management technique aimed at reducing a product’s life-cycle costs.



Target costing is almost the exact opposite of cost plus margin modeling where a company produces a product with no cost structure in mind. Once the product is built they add a profit margin on top to arrive at the final price.

In Target costing, we first determine what price we think the consumer will pay for our product. We then determine how much of a profit margin we expect and subtract that from the final price. The remaining amount left is what is available as a budget to be used to create the product.

Advantages of Target Costing

- Proactive approach to cost management.
- It reinforces top-to-bottom commitment to process and product innovation, and is aimed at identifying issues to be resolved, in order to achieve some competitive advantage.
- Target costing starts with customer's study or market study. It helps to create a company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success.
- It uses management control systems to support and reinforce manufacturing strategies; and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lowest cost.
- Target costing ensures proper planning well ahead of actual production and marketing.
- Implementation of Target Costing enhances employee awareness and empowerment.
- Foster partnership with suppliers.
- Minimize non-value-added activities.
- Encourages selection of lowest cost value added activities.
- Reduced time to market.
- Target Costing takes a market – driven approach towards cost, in which value is defined not only by what customers demand but also by what they are willing to pay for. This strategy introduces a discipline in which planning focus shifts to those costs that create value and meet the needs of the customer. By involving and educating customers, target costing provides a process that allows teams to make intelligent trade-offs between features, functionality and cost, resulting in designs that are better suited to customer's quality and price expectations.

Main features of Target Costing System

The main features of Target Costing System can be understood by going through the following points:

- Target costing is viewed as an *integral part of the design and introduction of new products*. As such, it is part of an overall profit management process, rather than simply a tool for cost reduction and cost management. The first part of the process is driven by customer, market and profitability considerations. Given that profitability is critical for survival, a target profit margin is established for all new product offerings. The target profit margin is derived from the company's long-term business plan, which incorporates its long-term strategic intent and profit margins. Each product or product line is required to earn at least the target profit margin.
- For any given product, *a target selling price is determined using various sales forecasting techniques*. Critical to setting the target selling price are the design specifications (reflecting certain levels of functionality and quality) of the new product. These specifications are based on customer requirements and expectations and are often influenced by the offerings of competitors. Importantly, while setting the target selling price, competitive conditions and customer's demand for increased functionality and higher quality, without significant increases in price, are clearly recognised, as charging a price premium may not be sustainable.

Hence, the *target selling price is market-driven* and should encompass a realistic reflection of the competitive environment.

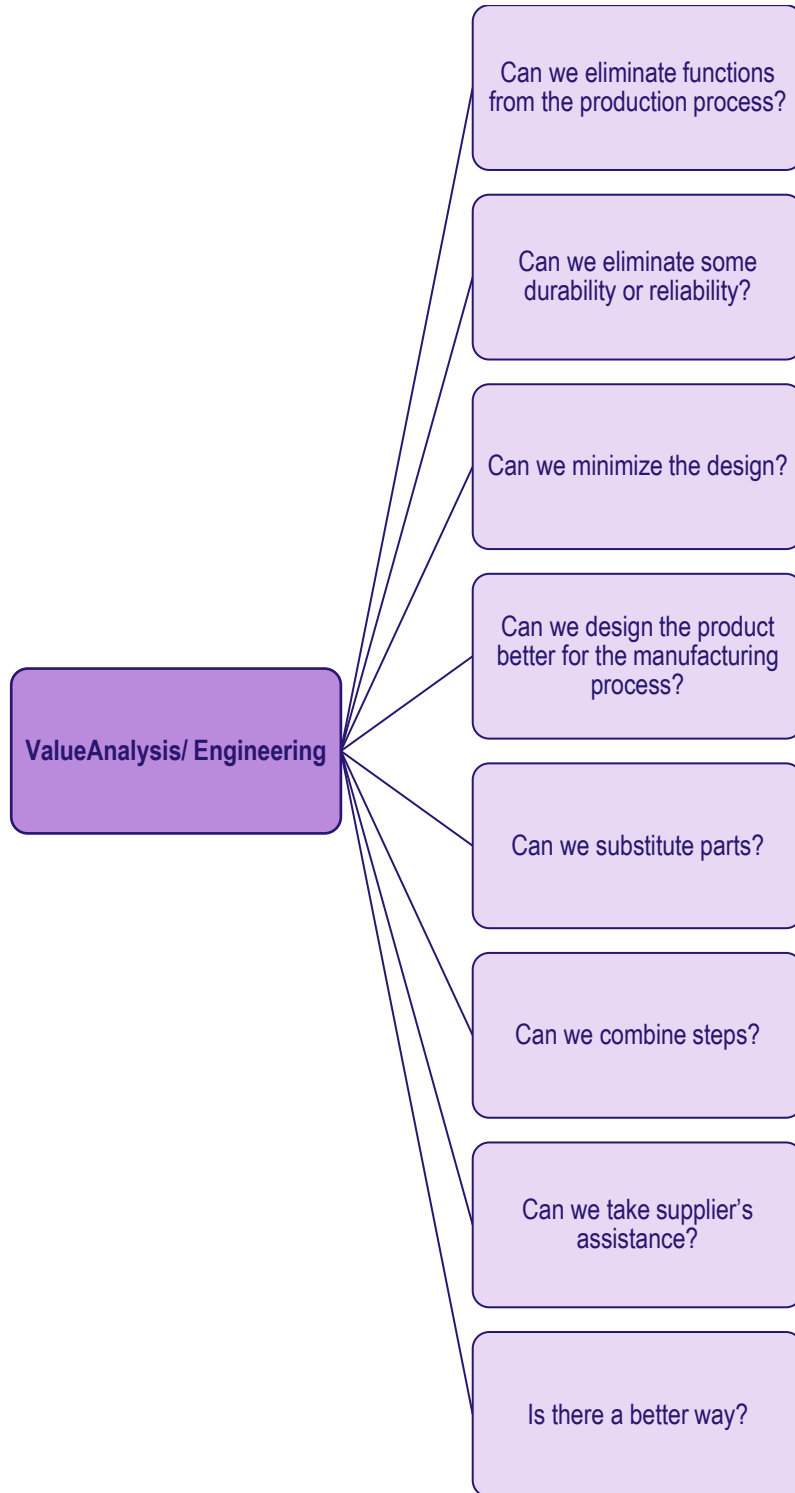
- Integral to setting the *target selling price is the establishment of target production volumes, given the relationship between price and volume*. The expected targets volumes are also critical to computing unit costs, especially with respect to capacity-related costs (such as tooling costs), as product costs are dependent upon the production levels over the life cycle of the product. Once the target selling price and required profit margin have been determined, the difference between these two figures indicates the allowable cost for the product. Ideally, the allowable cost becomes the target cost for the product. However, in many cases the target cost agreed upon will exceed the allowable cost, given the realities associated with existing capacities and capabilities.
- Establishing Cost Reduction Targets. The next stage of the target costing process is to determine *cost reduction targets*. Some firms will do this by estimating the “current cost” of the new product. The current cost is based on existing technologies and components, but encompasses the functionalities and quality requirements of the new product. The difference between the current cost and the target cost indicates the required cost reduction that is needed. This amount may be divided into a target cost-reduction objective and a strategic cost-reduction challenge. The former is viewed as being achievable (yet still a very challenging target), while the latter acknowledges current inherent limitations. After analyzing the cost reduction objective, a product-level target cost is set which is the difference between the current cost and the target cost-reduction objective.
- It should be noted that a fair degree of judgement is needed where the allowable cost and the target cost differ. As the ideal is to produce at the allowable cost, it is important that the difference is not too great. Once the product-level target cost is set, however, it generally cannot be changed, and the challenge for those involved is to meet this target.
- Having achieved consensus about the product-level target cost, a series of intense activities commence to translate the cost challenge into reality. These activities continue throughout the design stage up until the point when the new product goes into production.

Components of Target Costing System

Typically, the total target is broken down into its various components, each component is studied and opportunities for cost reductions are identified. These activities are often referred to as Value Analysis (VA) and Value Engineering (VE).

Value Analysis¹ is a planned, scientific approach to cost reduction which reviews the material composition of a product and production design so that modifications and improvements can be made which do not reduce the value of the product to the customer or to the user. **Value Engineering** is the application of value analysis to new products. Value engineering relates closely to target costing as it is cost avoidance or cost reduction **before production**. Value analysis is cost avoidance or cost reduction of a product already in production; both adopt the same approach i.e. a complete audit of the product.

Here are some of the issues that are dealt with during a Value Analysis/ Value Engineering review:



- **Can we eliminate functions from the production process?**

This involves a detailed review of the entire manufacturing process and determine the *non-value added* activities. By eliminating them, one can take their associated direct or overhead costs out of the product cost. However, these functions were originally put in for a reason, so the team must be careful to develop work-around steps that eliminate one or more activities from the original set of functions and be sure enough that eliminating these activities will not hamper the value- added activities in any manner.

- **Can we eliminate some durability or reliability?**

It is possible to design an excessive degree of sturdiness into a product. For example, a vacuum cleaner can be designed to withstand a 1-ton impact, although there is only the most vanishing chance that such an impact will ever occur; designing it to withstand an impact of 100 pounds may account for 99.999% of all probable impacts, while also eliminating a great deal of structural material from the design. However, this concept can be taken too far, resulting in a visible reduction in durability or reliability, so any designs that have had their structural integrity reduced must be thoroughly tested to ensure that they meet all design standards.

- **Can we minimize the design?**

This involves the creation of a design that uses fewer parts or has fewer features. This approach is based on the assumption that a minimal design is easier to manufacture and assemble. Also, with fewer parts to purchase, less procurement overhead is associated with the product. However, reducing a product to extremes, perhaps from dozens of components to just a few molded or prefabricated parts, can result in excessively high costs for these few remaining parts, since they may be so complex or custom made in nature that it would be less expensive to settle for a few extra standard parts that are more easily and cheaply obtained. Also, a proper trade-off between price and quality is necessary in this context.

- **Can we design the product better for the manufacturing process?**

Also, known as design for manufacture and assembly, this involves the creation of a product design that can be created in only a specific manner. For example, a toner cartridge for a laser printer is designed so that it can be successfully inserted into the printer only when the sides of the cartridge are correctly aligned with the printer opening; all other attempts to insert the cartridge will fail. When used for the assembly of an entire product, this approach ensures that a product is not incorrectly manufactured or assembled, which would call for a costly disassembly or (even worse) product recalls from customers who have already received defective goods.

- **Can we substitute parts?**

This approach encourages the search for less expensive components or materials that can replace more expensive parts currently used in a product design. It is becoming an increasingly valid approach since new materials are being developed every year. However,

sometimes the use of a different material impacts the types of materials that can be used elsewhere in the product, which may result in cost increases in these other areas, for a net increase in costs. Thus, any parts substitution must be accompanied by a review of related changes elsewhere in the design. This step is also known as component parts analysis and involves one extra activity—tracking the intentions of suppliers to continue producing parts in the future; if parts will not be available, they must be eliminated from the product design.

- **Can we combine steps?**

A detailed review of all the processes associated with a product sometimes reveals that some steps can be consolidated, which may mean that one can be eliminated (as noted earlier) or that several can be accomplished by one person, rather than having people in widely disparate parts of the production process perform them. This is also known as *process centering*. By combining steps in this manner, we can eliminate some of the transfer and queue time from the production process, which in turn reduces the chance that parts will be damaged during these transfers.

- **Can we take supplier's assistance?**

Another approach to value engineering is to call on the services of a company's suppliers to assist in the cost reduction effort. These organizations are particularly suited to contribute information concerning enhanced types of technology of materials, since they may specialize in areas that a company has no information about. They may have also conducted extensive value engineering for the components they manufacture, resulting in advanced designs that a company may be able to incorporate into its new products. Suppliers may have also redesigned their production processes, or can be assisted by a company's engineers in doing so, producing cost reductions or decreased production waste that can be translated into lower component costs for the company.

- **Is there a better way?**

Though this step sounds rather vague, it really strikes at the core of the cost reduction issue—the other value engineering steps previously mentioned focus on incremental improvements to the existing design or production process, whereas this one is a more general attempt to start from scratch and build a new product or process that is not based in any way on preexisting ideas. Improvements resulting from this step lend to have the largest favourable impact on cost reductions but can also be the most difficult for the organization to adopt, especially if it has used other designs or systems for the production of earlier models.

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A mix of all the value engineering steps noted above must be applied to each product design to ensure that the maximum permissible cost is safely reached. Also, even if a minimal amount of value engineering is needed to reach a cost goal, one should conduct the full range of value engineering analysis anyway, since this can result in further cost reductions that improve the margin of the product or allow management the option of reducing the product's price, thereby creating a problem for competitors who sell higher-priced products.

The initial value engineering may not uncover all possible cost savings. Thus, **Kaizen Costing** is designed to repeat many of the value engineering steps for as long as a product is produced, constantly refining the process and thereby stripping out extra costs (already discussed in Chapter-3). The cost reductions resulting from kaizen costing are much smaller than those achieved with value engineering but are still worth the effort 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 while continuing to reduce cost.

The type of cost reduction program used for target costing has an impact on the extent of cost reduction, as well as on the nature of the components used in a product. When a design team elects to set cost reduction goals by allocating specific cost reduction amounts to major components of an existing product, it tends to focus on finding ways to make incremental cost reductions rather than focusing on entirely new product configurations that might both radically alter the product's design and lower its cost. This approach is most commonly used during the redesign of products already in the market. Another cost reduction approach is to allocate cost reductions based on the presence of certain product features in a product design. This method focuses the attention of the design team away from using the same components that were used in the past, which tends to produce more radical design changes that yield greater cost savings. However, the latter approach is also a riskier one, since the resulting product concepts may not work, and also requires so much extra design work that the new design may not be completed for a long time. Therefore, the second method is generally reserved for situations where a company is trying to create products at a radically lower cost than previously.

Further, *Target Costing System is based on involving representatives of all the Value Chain such as suppliers, agents, distributors and existing after-sales service in the target costing system. This aim to spread concepts and efforts to reduce the cost over all the value chain through the development of the spirit co-operation and understanding among all members of organizations associated with the product from suppliers, producers, customers, agents and service providers. The target costing system is based on the concept of long-term relations and mutual benefits in the long term between suppliers and all members of representatives of all the value chain².*

All the changes noted in this section that are necessary for the implementation and use of the target costing methodology represent a massive change in mind-set for the product design personnel of any company because they require the constant cooperation of many departments and rapid, voluminous communications between them. All these concepts run counter to the traditional approach.

(Source: 1. Value Analysis, Functional Analysis, Value Engineering and Target Costing by Norwood Whittle; 2. The Relationship between Target Costing and Competitive Advantage, International Journal of Business and Management Vol. 7, No. 8; April 2012)

Case Scenario

Queenstown Wood Co. (QWC) began 20 years ago, as a small family-run business supplying custom-made school furniture. Now QWC has grown into a thriving hub of experts specializing in either custom-made, locally sourced or quality imported commercial grade furniture. The newly appointed CFO is concerned about the trends in dropping sales volumes, increasing costs, and hence falling profits over the last three years. He observed that the reason of these trends is increased cut-throat competition that has emerged over the last three years. For many years, QWC has been known for high quality but now this quality is being matched by the competitors. QWC's share of the market is declining due to equivalent products being sold by competitors at lower prices. It is considered that, to offer such low prices, the furniture's production costs of the competitors must be lower than QWC's.

Required

ADVISE how QWC can improve its sales volumes, costs and profits using Value Analysis and Functional Analysis.

Solution

Value Analysis is viewed as a reduction in cost and problem solving technique. Such technique analyses an *existing product* to identify and cutback or eliminate any cost which do not give any contribution to performance or value. It is a planned, scientific approach to cost reduction which reviews the *material composition* of a product and *production design* so that modifications and improvements can be made which do not reduce the value of the product to the customer or to the user. (i.e. quality for purpose should not be compromised.)

Functional analysis is applied to the design of *new products* and breaks the product down into functional parts. For example, a new chair may have the moveable feature. The value that the customer places on each feature is considered and added to give a target cost. Thus, functional analysis aims to increase profits by reducing costs through elimination of *unnecessary features* and/or by adding cost-effective *new features* that are so *attractive to customers* that the product becomes more lucrative.

The result of the above analysis is to improve the value of the furniture while maintaining costs and/or cutback the costs of the furniture without compromising with value. It is clear from the scenario that QWC needs to cut back its selling prices to compete in the market. This selling price reduction can only be possible by a reduction in QWC's unit costs; however, such reduction must not be accomplished by compromising with quality. Both value analysis and functional cost analysis may be used for QWC; however, value analysis is likely to be a more useful technique because office tables and chairs are such items which are demanded more on the basis of their use value rather than their esteem value.

Problems with Target Costing

Though the target costing system results in clear, substantial benefits in most cases, it has a few problems that one should be aware of and guard against. These problems are as follows:

- *The development process can be lengthened to a considerable extent* since the design team may require a number of design iterations before it can devise a sufficiently low-cost product that meets the target cost and margin criteria. This occurrence is most common when the project manager is unwilling to “pull the plug” on a design project that cannot meet its costing goals within a reasonable time frame. Usually, if there is no evidence of rapid progress toward a specific target cost within a relatively short period of time, it is better to either ditch a project or at least shelve it for a short time and then try again, on the assumption that new cost reduction methods or less expensive materials will be available in the near future that will make the target cost an achievable one.
- A large amount of mandatory cost cutting can *result in finger-pointing in various parts of the company*; especially if employees in one area feel they are being called on to provide a disproportionately large part of the savings. For example, the industrial engineering staff will not be happy if it is required to completely alter the production layout in order to generate cost savings, while the purchase staff is not required to make any cost reductions through supplier negotiations. Avoiding this problem requires strong interpersonal and negotiation skills on the part of the project manager.
- Representatives from number of departments on the design team can sometimes make it more *difficult to reach a consensus on the proper design* because there are too many opinions regarding design issues. This is a major problem when there are particularly stubborn people on the design team who are holding out for specific product features. Resolving out is difficult and requires a strong team manager, as well as a long-term commitment on the part of a company to weed out those who are not willing to act in the best interests of the team.
- Effective implementation and use *requires the development of detailed cost data*. This can be really costly and may not be profitable for the company when a detailed cost-benefit analysis is done.
- Use of target costing *may reduce the quality of products* due to the use of cheap components which may be of inferior quality.
- For every problem area outlined have the dominant solution is retaining strong control over the design teams, which calls for a good team leader. This person must have an exceptional knowledge of the design process, good interpersonal skills, and a commitment to staying within both time and cost budgets for a design project.

Management Accountant's Role in a Target Costing Environment

- The management accountant should be able to *provide for the other members of the design team a running series of cost estimates based on initial designs sketch*, activities based costing reviews of production processes, and “best guess” costing information from suppliers based on estimated production volumes. Essentially in the earliest stages of a design, accountant works

with vague costing information and so must be able to provide estimates within a high-low range costs, gradually tightening this estimated cost range as more information becomes available.

- The management accountant should also be *responsible for any capital budgeting* requests generated by the design team since he or she has the knowledge of the capital budgeting process, how to fill out the required forms, and precisely what types of equipment are needed for the anticipated product design. The management accountant also becomes the key contact on the design team for answers to any questions from the finance staff regarding issues or uncertainties in the capital budgeting proposal.
- The management accountant should work with the design team to help it understand the nature of various costs (such as cost allocations based on an activity-based costing system), as well as the *cost-benefit trade-offs of using different design or cost operations* in the new product.
- In addition, the management accountant is *responsible for tracking the gap between the current cost of a product design and the target cost* that is the design team's goal, providing an itemization of where cost savings have already been achieved and where there has not been a sufficient degree of progress.
- Finally, the management accountant must continue to *compare a product's actual cost to the target cost after the design is completed*, and for as long as the company sells the product. This is a necessary step because management must know immediately if costs are increasing beyond budgeted levels and why these increases are occurring.

There are particular qualifications that a management accountant must have to be assigned to a target costing team. Certainly, one is having a good knowledge of company products as well as their features and components. Also, the management accountant must know how to create an activity based costing system to evaluate related production costs, or at least interpret such costing data developed by someone else. Further, he or she must work well in a team environment, proactively assisting other members of the team in constantly evaluating the costs of new design concepts. In addition, he or she should have good analytical and presentation skills, since the ongoing costing results must be continually presented not only to other members of the team but also to the members of the milestone review committee. Thus, the best management accountant for this position is an outgoing person with several years of experience within a company or industry.

Impact of Target Costing on Profitability

Target costing can have a startlingly large positive impact on profitability, depending on the commitment of management to its use, the constant involvement of management accountants in all stages of a product's life cycle, and the type of strategy a company follows. Target costing improves profitability in two ways.

- It places such a detailed *continuing emphasis on product costs throughout the life cycle* of every product that it is unlikely that a company will experience runaway costs; also, the management team is completely aware of costing issues since it receives regular reports from the management accounting members of all design teams.
- It improves profitability through *precise targeting of the correct prices* at which the company feels it can field a profitable product in the marketplace that will sell in a robust manner. This is opposed

to the more common cost-plus approach under which a company builds a product, determines its cost, tacks on a profit and then does not understand why its resoundingly high price does not attract buyers. Thus, target costing results not only in better cost control but also in better price control.



A company's strategy can also have its impact on profitability. If it constantly issues a stream of new products, or if its existing product lines is subject to severe pricing pressure, it *must make target costing a central part of its strategy* so that the correct price points are used for products and actual costs match those originally planned. However, there are other strategies, such as growth by geographical expansion of the current product line (as is practiced by retail stores) or growth by acquisition, where there is no particular need for target costing—these companies make their money in other ways than by a focused concentration on product features and costs.

If the issues presented here are properly dealt with by a management team, it should find that target costing is one of the best accounting methods available for improving profitability. It is indeed one of the most pro-active systems found in the entire range of accounting knowledge.

Target Costing Data Flow

- Data can be obtained from *central accounting data base* carefully stocked from such a variety of sources as accounts payable, billing, bills of materials and inventory records.

- In initial stages of product design, the cost accountant must make the best possible *guesses regarding the cost of proposed designs*.
- The cost accountant may include the *best estimate an additional estimate of the highest possible cost* that will be encountered. This additional information lets management know whether there is a significant degree of risk that the project may not achieve its desired cost target.
- Data can also be obtained from *competitor's information collected by the marketing staff or an outside research agency*. This database contains information about the prices at which competitors are selling their products, as well as the prices of ancillary products and perhaps also the discounts given at various price points. It can also include market share data for individual products or by firm, the opinion of customers regarding the offerings of various companies, and the financial condition of competitors. This information is mostly used to determine the range of price points at which a company should sell its existing or anticipated products,
- Sometimes information is compiled by a combined effort of the marketing and engineering staffs through a process called *reverse engineering*. This source can also serve as a data base for the project team.
- Engineering staff also compiles their own cost data relating to different designs/components. *This data is collected over the years* and can be useful for target costing.
- The final database available to the cost accounting member of a design team contains information regarding the previous quality, cost and on-time delivery performance of all key suppliers, as well as the production capacity of each one.

Most Useful Situations for Target Costing

Target costing is most useful in situations where the majority of product costs are locked in during the product design phase. This is the case for most manufactured products, but few services. In the services area, such as consulting, the bulk of all activities can be reconfigured for cost reduction during the "production" phase, which is when services are being provided directly to the customer. In the services environment, the "design team" is still present but is more commonly concerned with streamlining the activities conducted by the employees providing the service, which can continue to be enhanced at any time, not just when the initial services process is being laid out.

Whenever a new and innovative approach to doing business is discovered, the question arises as to which clients and potential clients might this methodology provide an appropriate fit. In addition, and consistent with many new financial or operational approaches, target costing may not be for everyone. Some companies, which seem to benefit most from target costing, are those, which maintain the following criteria:

- Assembly-oriented industries, as opposed to repetitive-process industries that produce homogeneous products;
- Involved heavily with the diversification of the product lines;

- Use technologies of factory automation, including computer-aided design, flexible manufacturing systems, office automation, and computer-aided manufacturing;
- Have experienced shorter product life cycles where the pay-back for factory automation typically must be achieved in less than eight years;
- Must develop systems for reducing costs during the planning, design and development phases of a product's life cycle;
- Are implementing management methods such as just-in-time, value engineering.

The above listing is not completely exhaustive as a variety of factors are at work to promote the usefulness of target costing in other companies.

Target Costing & Fast-Food Restaurant

Design team can lay out the floor plan of a fast-food restaurant, with the objective of creating an arrangement that allows employees to cover the shortest possible distances while preparing food and serving customers; this is similar to the design of a new product. However, unlike a product design, this layout can be readily altered at any time if the design team can arrive at a better layout, so that the restaurant staff can continue to experience high levels of productivity improvement even after the initial design and layout of the facility. In this situation costs are not locked in during the design phase, so there is less need for target costing.

Target Costing & Chemical Production Industry

Another situation where target costing results in less value is the production of raw materials, such as chemicals. In this case, there are no design features; instead, the industrial engineering staff tries to create the most efficient possible production process, which has little to do with cost reduction through the improvement of customer value.

Target Costing Control Points

Control Points which should be taken care of in all target costing projects:

- **Identification of Principal Control Point:** Experience shows that there always comes a point, where the cost of maintaining the design team exceeds the savings garnered from additional iterations. It is also necessary that most products should be launched within a reasonably short time or they will miss the appropriate market, where they will beat the delivery of competing products to the market. This emphasis that the principal control points over the course of target costing programme should be properly taken care of.
- **Point of Go/No Go Decision:** If target costing is not reached, management retains power to abandon the design project. There comes a point, when actual performance is very close to expected performance in matter of cost incurrence.
- **Milestone can be in terms of Timer or Points:** A milestone can be in terms of time, say one month. It can also be on the points in design process, at which specific activities are completed.

Implementing a Target Costing System

A target costing initiative requires the participation of several departments. Because there are so many participants in the process from so many departments, some of whom have different agendas in regard to what they want the program to produce. Design projects can be delayed by squabbling or by an inability to drive down design or production costs in a reasonably efficient manner. This delay may lead to serious cost overruns in the cost of the design team itself, which can lead to abrupt termination of the entire target costing system by the management team. However, these problems can be mitigated or completely eliminated by ensuring that the steps listed here are completed when the target costing system is first installed:

- **Create a Project Charter:** The target costing effort should begin with a document, approved by senior management that describes its goals and what it is authorized to do. This document, known as the project charter, is essentially a subset of the corporate mission statement and related goals as they pertain to the target costing initiative. Written approval of this document by the senior management group provides the target costing effort with a strong basis of support and direction in all subsequent efforts.
- **Obtain a Management Sponsor:** The next step is to obtain the strongest possible support from a management sponsor. This should be an individual who is well positioned near the top of the corporate hierarchy, believes strongly in the goals of target costing, and will support the initiative in all respects—obtaining funding, lobbying other members of top management, working to eliminate road blocks, and ensuring that other problems are overcome in timely manner. This person is central to the success of target costing.
- **Obtain a Budget:** The target costing program requires funds to ensure that one or more well-staffed design teams can complete target costing tasks. The funding should be based on a formal allocation of money through the corporate budget, rather than a parsimonious sub allocation grudgingly granted by one or more departments. In the first case the funds are unreservedly given to the target costing effort, whereas in the latter case, they can be suddenly withdrawn by a department manager who is not fully persuaded of the need for target costing or who suddenly finds a need for the money elsewhere.
- **Assign a Strong Team Manager:** Because the typical target costing program involves so many people with different backgrounds and represents so many parts of a company, it can be difficult to weld the group together into a smoothly functioning team focused on key objectives. The best way to ensure that the team functions properly is to assign to the effort a strong team manager skilled in dealing with management, the use of project tools, and working with a diverse group of people. This manager should be a full-time employee, so that his or her complete attention can be directed toward the welfare of the project.
- **Enroll Full-Time Participants:** A target costing team member puts the greatest effort into the program when he or she is focused only on target costing. Thus, it is essential that as many members of the team as possible be devoted to it full-time rather than also trying to fulfill other commitment elsewhere in the company at the same time. This may call for the replacement of these individuals in the departments they are leaving so that there are no

emergencies requiring their sudden withdrawal back to their “home” departments to deal with other work problems. It may even be necessary to permanently assign them to a target costing program, providing them with a single focus on ensuring the success of the target costing program because their livelihood are now tied to it. As discussed above, a full-time Management Accountant should be employed for target costing who carries out the cost-benefit analysis on a continuous basis.

- **Use Project Management Tools:** Target costing can be a highly complex effort especially for high-cost products with many features and components. To ensure that the project stays on track, the team should use all available project management tools, such as Microsoft Project (for tracking the completion of specific tasks), a company database containing various types of costing information, and a variety of product design tools. All these items require assured access to many corporate databases, as well as a budget for whatever computing equipment is needed to access this data.

The main focus of the step described in this section is to ensure the fullest possible support for target costing by all available means—management, money and staff. Only when all these elements are in place and concentrated on the goals at hand does a target costing program have the greatest chance for success.

Illustration

Kowloon Toy Company (KTC) expects to successfully launch Toy “H” based on a Disney character. KTC must pay 15% royalty on the selling price to the Disneyland. KTC targets a selling price of ₹100 per toy and profit of 25% on selling price.

The following are the cost data forecast:

	₹/toy
Component H ₁	8.50
Component H ₂	7.00
Labour: 0.40 hr. @ ₹60 per hr.	24.00
Product Specific Overheads	13.50

In addition, each toy requires 0.6 kg of other materials, which are supplied at a cost of ₹16 per kg. with a normal 4% substandard quality, which is not usable in the manufacture.

Required

DETERMINE if the above cost structure is within the target cost. If not, what should be the extent of cost reduction?

Solution**Target Cost “H”**

₹ / Toy	
Target Selling Price	100.00
Less: Royalty @15%	15.00
Less: Profit @ 25%	25.00
Target Cost	60.00

Cost Structure “H”

₹ / Toy	
Component H ₁	8.50
Component H ₂	7.00
Labour (0.40 hr. × ₹ 60 per hr.)	24.00
Product Specific Overheads	13.50
Other Material (0.6 kg / 96% × ₹16)	10.00
Total Cost of Manufacturing	63.00

Total Cost of Manufacturing is ₹ 63 while Target Cost is ₹ 60. Company KTC should make efforts to **reduce its manufacturing cost by ₹ 3** to achieve Target Selling Price of ₹100.

Case Scenario

Kaveri Ltd. (KL) is a manufacturer of bikes in India and it sells them in India and outside India. KL has just launched the World's smallest and most affordable bike called 'Zingaroo'. The bike is mounted with all-aluminium, single cylinder, air cooled, 99.2 cc engine. The engine makes just over 8 bhp power and 8 Nm of torque, but it stakes claim to be the fuel-efficient bike, with a claimed figure of 88 kmpl. It has been creating competition for two wheelers as none of the Indian companies as well as foreign companies, offer a bike for such a competitive price within the reach of middle class family.

KL has adopted target costing technique in manufacturing this bike. For KL, maintaining target-price was difficult. During the designing and production process of bike, input costs increased frequently. However, KL designed various components especially for bike to maintain the target price. Though, one curiosity how this can be done in the future when input costs are bound to increase further.

Many environmentalists have opposed the manufacture of this bike, because they believe that mass production of small bike (about 2.5 lakh bike every year) will create heavy pollution. Many people believe that this small bike is not up to the safety standards due to lightweight and use of aluminium and plastic frames. The design of this bike is entirely different from that of other bikes. This also causes a doubt that the existing bike mechanics would be able to repair or not.

Durability of bike is another issue in the Indian environment. Further, performance of 'Zingaroo' more or less depends upon the condition of roads and traffic system.

After the launch of 'Zingaroo', many other national and international automobile companies are also planning to manufacture small bike which will create tough competition in near future.

Required

Now you being a strategic performance analyst of KL, answer the following questions:

- (i) IDENTIFY strategy which KL has adopted for 'Zingaroo' bike?
- (ii) After adopting target costing, IDENTIFY issues and challenges faced by KL and suggest the remedial action to be taken to solve these issues?

Solution

- (i) KL has adopted *Low Cost Strategy* for "Zingaroo" bike since the main purpose of manufacturing this bike was to make it cheapest and affordable.
- (ii) The issues and challenges faced by KL and their remedial action are as follows:

Maintaining of Target Price

'Zingaroo' bike is one of the world's cheapest and smallest bike. Maintaining target-price proved to be a big challenge for the KL since input cost of bike are bound to increase further in future. The initial value engineering may not uncover all possible cost savings. Thus, Kaizen Costing may be designed to repeat many of the value engineering steps for as long as a bike is produced, constantly refining the process and thereby stripping out extra costs.

Environmental Issues

Many environmentalists have opposed the manufacture of bike as they believe that mass production of small bikes will create heavy pollution since automobile pollution is already a big problem for a country like India. For this issue, 'Zingaroo' bike can be prepared based on BS emission norms. These norms restrict the pollution created by any motor vehicle.

Safety Issues

Since 'Zingaroo' bike is made of aluminium and plastic frames so this may also create safety issues for the customers. For such issues, KL should meet safety standards. Further, KL should make people aware that 'Safety is Primary' / 'Drive Safely'.

Servicing/ Repairing Facilities

The design of 'Zingaroo' bike is entirely different from that of other bikes. This causes a doubt that the existing bike mechanics would be able to repair or not. For such problem, creation of a good network of service center can be a solution i.e. repair center should be established on required places.

Durability

Durability of 'Zingaroo' bike is another issue in the Indian environment. The performance of bike more or less depends upon the condition of roads and traffic system. For such

issues, tyre quality and hydraulic brake system should be compatible to the roads and traffic system.

Global Competition

After the launch of 'Zingaroo', many other national and international automobile companies are also planning to manufacture a small bike, which will be a big challenge for the KL in the near future. To face such competition, it may adopt Kaizen Costing technique. The cost reductions resulting from Kaizen Costing are much smaller than those achieved with Value Engineering but are still worth the effort since competitive pressures are likely to force down the price of 'Zingaroo' over time, and any possible cost savings allow KL to still attain its targeted profit margins while continuing to reduce cost.

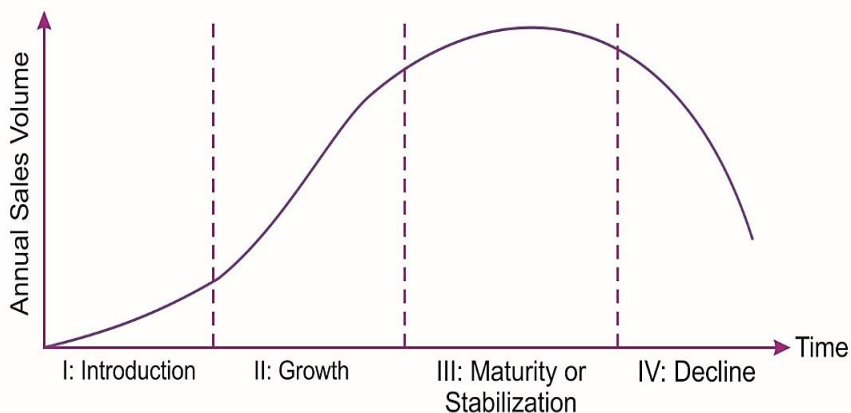
LIFE CYCLE COSTING

Life Cycle Costing involves identifying the costs and revenue over a product's life i.e. from inception to decline. Life cycle costing aims to maximize the profit generated from a product over its total life cycle. Understanding this can be a useful analysis tool and can help to suggest which strategies the organisation needs to adopt in order to compete successfully.

Product Life Cycle

Each product has a life cycle. The life cycle of a product varies from a few months to several years. Product life cycle is thus a pattern of expenditure, sales level, revenue and profit over the period from new idea generation to the deletion of product from product range.

The life cycle of a product consists of four phases/ stages viz., Introduction; Growth; Maturity; Saturation and Decline.



Stage I: Introduction Stage

Stage one is where the new product is launched in the market. As the product is novel, there is minimal awareness and acceptance of it. Competition is almost negligible and profits are non-existent. The length of the introduction stage differs from product to product depending on various factors.

Characteristics

Decisions about the product branding, packaging and labelling	High distribution and promotional expenses	Profits are low or negative due to low initial volume
Pricing may be low-penetration or high-skimming pricing	Huge efforts to attract various marketing channels	Aggressive promotional efforts to increase awareness
Product refinements are not possible	Few competitors produce basic version of products	Focus on those buyers who are the most ready to buy

Strategies

- Attracting customers by raising awareness of the product through promotion activities.
- Inducing customers to try and buy the product.
- Strengthening or expanding channel and supply chain relationships.
- Building on the availability and visibility of the product that boost channel intermediaries to support the product.
- Setting price in alignment with the competitive realities of the market.

Stage II: Growth Stage

The next stage in the product life cycle is growth stage. Sales begin to expand rapidly because of greater customer awareness. Competitors enter the market often in large numbers. As a result of competition, profit starts declining near the end of the growth stage.

Characteristics

High volume of business and increase in competition	Sales increase at an increased rate in early growth stage	New channels to handle additional volumes and new markets
Shift of emphasis from product awareness to product conviction	Overall strategy for trade-off between high profits and high market share	Improving and/or adding features or strategic lowering of prices to attract more buyers
Same promotional spending or slightly higher	Educating market is main goal	The length of the growth stage varies according to the nature of the product and competitive reactions

Strategies

- Establish a clear brand identity through promotional campaigns.
- Maintain control over product quality to assure customer satisfaction.
- Maximize availability of the product through strong distribution channel.
- Find the ideal balance between price and demand as per price elasticity.
- Overall strategy shifts from acquisition to retention of customers, from motivating product trial to generating repeat purchases and building brand loyalty.
- Development of long-term relationships with customers and partners for the maturity stage.
- Value-based pricing strategies may be considered.
- Leverage the product's *perceived* differential advantages to secure a strong market position.

Stage III: Maturity Stage

During the stage of maturity sales continue to increase, but at a decreasing rate. When sales level off, profits of both producers and middlemen decline. The main reason is intense price competition; some firms extend their product lines with new models. This stage poses difficult challenges.

Characteristics

Overcapacity in the industry	Intensified competition	Population growth and replacement demand govern future sales
Some laggard buyers still enter the market	Profits start to decline	No new distribution channels to fill
Customers start moving towards other products and substitutes	Strong marketing challenges	High R & D budgets

Strategies

- Strong marketing efforts are needed to win over the competitor's customers.
- Product features may be improved or enhanced to differentiate product from that of the competitors.
- Prices may have to be reduced to attract the price-sensitive consumers.
- Various sales promotion incentives are necessary for the consumers as well as dealers to maintain their interest in the product.
- Distribution becomes more intensive and incentives may be offered to encourage product over competing products.

Stage IV: Decline Stage

Decline in sales volume characterizes this last stage of the product life cycle. The need or demand for product disappears. Availability of better and less costly substitutes in the market accounts for the arrival of this stage.

Characteristics



Strategies

- The product can be maintained in the market by differentiation, keeping low cost for some more time by adding certain new features and finding new uses.
- The firm can continue to offer the product to its loyal customers (niche segment) at a reduced price.
- Firm can even discontinue the product.
- Use the product as replacement product for launching another new product successfully in the market.
- The various marketing decisions in the decline stage will depend on the fact that, whether it is being revived, or given a new lease of life, or left unchanged if it is being liquidated.
- The price may be maintained or reduced drastically if liquidated.

Life Cycle Characteristics

	Introduction	Growth	Maturity	Decline
Objectives	Create product awareness & trial	Maximise market share	Maximise profits while defending market share	Reduce expenditures & milk the brand
Sales	Low sales	Rapidly rising	Peak sales	Declining sales
Costs per Customer	High cost per customer	Average cost per customer	Low cost per customer	Low cost per customer
Profits	Negative	Rising profits	High profits	Declining profits
Customers	Innovators	Early adopters	Middle majority	Laggards
Competitors	Few	Growing number	Steady number beginning to decline	Declining number

Strategies

	Introduction	Growth	Maturity	Decline
Product	Offer basic product	Offer product extensions, service & warranty	Diversify brands and models	Phase out weak items
Price	Cost plus profit	Price to penetrate market	Price to match or beat competitors	Price cutting
Advertising	Build product awareness amongst early adopters & dealers	Build awareness & interest in mass market	Stress on brand differences and benefits	Reduce level to keep hard core loyalty
Distribution	Build selective distribution	Build Intensive distribution	Build more intensive distribution	Go selective: Phase out unprofitable outlets
Sales Promotion	Use heavy sales promotion to entice trial	Reduce to take advantage of heavy consumer demand	Increase to encourage brand switching	Reduce to minimal level

(Sources- Stages- Characteristics/ Strategies: Marketing Strategy, Text and Cases By O. C. Ferrell, Michael Hartline; Principles of Marketing By Philip Kotler)

Characteristics of Product Life Cycle

The major characteristics of product life-cycle concept are as follows:

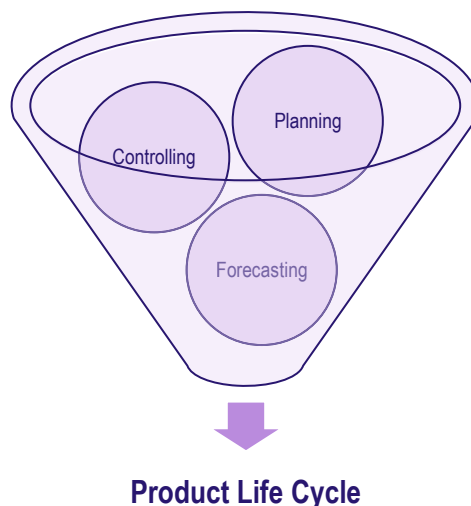
- The products have finite lives and pass through the cycle of development, introduction, growth, maturity, decline and deletion at varying speeds.
- Product cost, revenue and profit patterns tend to follow predictable courses through the product life cycle. Profits first appear during the growth stage and after stabilising during the maturity stage, decline thereafter to the point of deletion.
- Profit per unit varies as products move through their life cycles.
- Each stage of the product life-cycle poses different threats and opportunities that give rise to different strategic actions.
- Products require different functional emphasis in each stage-such as an R&D emphasis in the development stage and a cost control emphasis in the decline stage.
- Finding new uses or new users or getting the present users to increase their consumption may extend the life of the product.

Benefits of Product Life Cycle Costing

The benefits of product life cycle costing are summarized as follows:

- The product life cycle costing results in *earlier actions to generate revenue or to lower costs* than otherwise might be considered. There are a number of factors that need to be managed in order to maximise return on a product.
- Better decisions should follow from a *more accurate and realistic assessment of revenues and costs*, at least within a particular life cycle stage.
- Product life cycle thinking can promote *long-term rewarding* in contrast to short-term profitability rewarding.
- It provides an *overall framework for considering total incremental costs over the entire life span of a product*, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.
- It is an approach used to provide a *long-term picture of product line profitability*, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.
- It is also considered as a way to enhance the *control of manufacturing costs*. The thrust of product life cycle costing is on the distribution of costs among categories changes over the life of the product, as does the potential profitability of a product. Hence it is important to track and measure costs during each stage of a product's life cycle.
- Product life cycle costing *traces research and design and development costs etc.*, incurred to individual products over their entire life cycles, so that the total magnitude of these costs for each individual product can be reported and compared with product revenues generated in later periods.

Uses of Product Life Cycle (PLC)



- As a Planning tool, it characterizes the marketing challenges in each stage and poses major alternative strategies, i.e. application of kaizen.
- As a Control tool, the PLC concept allows the company to measure product performance against similar products launched in the past.
- As a Forecasting tool, it is less useful because sales histories exhibit diverse patterns and the stages vary in duration.

Illustration

Y-Connections, China based firm, has just developed ultra-thintablet S-5 with few features like the ability to open two apps at the same time. This tablet cost ₹ 5,00,000 to develop; it has undergone extensive research and is ready for production. Currently, the firm is deciding on plant capacity, which could cost either ₹ 35,00,000 or ₹ 52,00,000. The additional outlay would allow the plant to increase capacity from 500 units to 750 units. The relevant data for the life cycle of the tablet at different capacity level are as under:

Expected Sales	500 units	750 units
Sale Price	₹ 79,600 per unit	₹ 69,600 per unit
Variable Selling Costs	10% of Selling Price	10% of Selling Price
Salvage Value - Plant	₹ 6,25,000	₹ 9,00,000
Profit Volume Ratio	40%	

Required

ADVISE Y-Connections, regarding the 'Optimal Plant Capacity' to install. The tablet's life cycle is two years.

Note: Ignore the time value of money.

Solution

Advice

Based on the above 'Expected Profit' statement which is purely based on *financial considerations* firm may go for high price – low volume i.e. 500 units level. However, *non-financial considerations* are also given due importance as they account for actions that may not contribute directly to profits in the short run but may contribute significantly to profits in long run. Here, it is important to note that life cycle of product is two years and there is no significant difference between the profits at both levels. In this scenario firm may opt the plant having high capacity *not only to increase its market share but also to establish a long term brand image.*

Workings**Statement Showing “Variable Manufacturing Cost per unit”**

Particulars	₹ / unit
Sales	79,600
Less: Contribution (40%)	31,840
Variable Cost	47,760
Less: Variable Selling Costs ($₹79,600 \times 0.1$)	7,960
Variable Manufacturing Cost	39,800

Statement Showing “Expected Profit”

Particulars	('000) ₹ / unit	
	500 units	750 units
Sales	39,800 (₹79,600 × 500)	52,200 (₹69,600 × 750)
Less: Variable Mfg. Cost	19,900 (₹39,800 × 500)	29,850 (₹39,800 × 750)
Less: Variable Selling Cost	3,980 (₹39,800 × 0.1)	5,220 (₹52,200 × 0.1)
Add: Salvage Value	625	900
Less: Cost of Plant	3,500	5,200
Net Profit	13,045	12,830

Development cost is sunk and is not relevant.


PARETO ANALYSIS

Pareto Analysis is a rule that recommends focus on the most important aspects of the decision making in order to simplify the process of decision making. It is based on the 80: 20 rule that was a phenomenon first observed by Vilfredo Pareto, a nineteenth century Italian economist. He noticed that 80% of the wealth of Milan was owned by 20% of its citizens. This phenomenon, or some kind of approximation of it say, (70: 30 etc.) can be observed in many different business situations. The management can use it in a number of different circumstances to direct management attention to the key control mechanism or planning aspects. It helps to clearly establish top priorities and to identify both profitable and unprofitable targets.

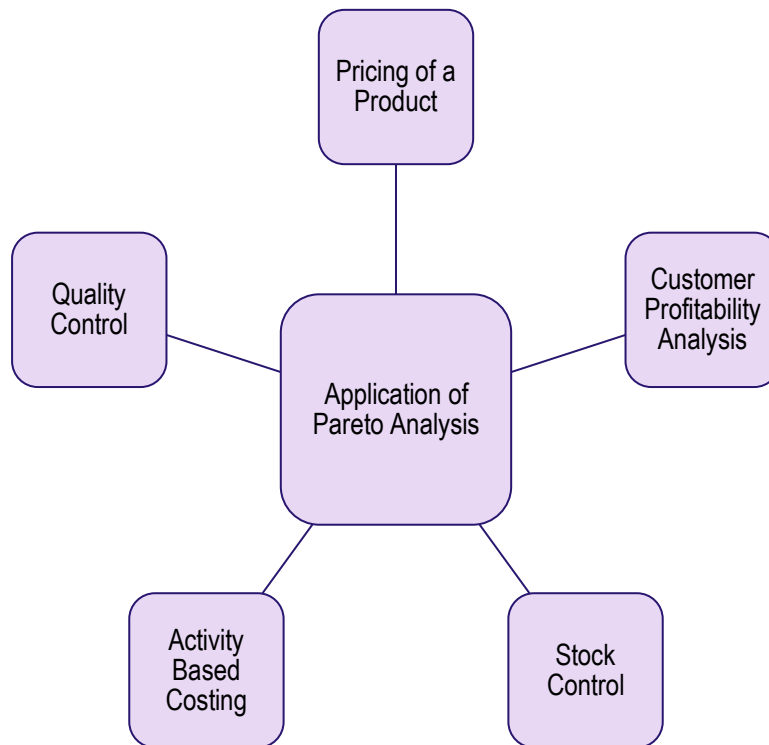
Usefulness of Pareto Analysis

It provides the mechanism to control and direct effort by fact, not by emotions. It helps to clearly establish top priorities and to identify both profitable and unprofitable targets. Pareto analysis is useful to:

- Prioritize problems, goals, and objectives to identify root causes.
- Select and define key quality improvement programs.
- Select key customer relations and service programs.
- Select key employee relations improvement programs.
- Select and define key performance improvement programs.
- Allocate physical, financial and human resources.

Applications of Pareto Analysis

Pareto analysis may be applicable in the presentation of Performance Indicators data through selection of representative process characteristics that truly determine or directly or indirectly influence or conform the desired quality or performance result or outcome. The Pareto Analysis is generally applicable to the following business situations:



Pricing of a Product

- In the case of a firm dealing with multi products, it would not be possible for it to analyse cost-profit-price-volume relationships for all of them. In practice, in case of such firm approximately 20% of products may account for about 80% of total sales revenue. Pareto Analysis is used for analysing the firm estimated sales revenues from various products and it might indicate that approximately 80% of its total sales revenue is earned from about 20% of its products.

- Such analysis helps the top management to delegate the pricing decision for approximately 80% of its products to the lower levels of management, thus freeing themselves to concentrate on the pricing decisions for products approximately 20% which are essential for the company's survival.
- Thus, a firm can adopt more sophisticated pricing methods for small proportion of products that jointly accounts for approximately 80% of total sales revenue. For the remaining 80% of the products which account for 20% of total sales revenue the firm may use cost based pricing method.

Customer Profitability Analysis

- Instead of analysing products, customers can be analysed for their relative profitability to the organisation.
- Again, it is often found that approximately 20% of customers generate 80% of the profit. There will always be some customers who are less profitable than others, just as some products are less profitable than others.
- Such an analysis is useful tool for evaluation of the portfolio of customer profile and decision making such as whether to continue serving a same customer group, what is the extent of promotion expenses to be incurred.

ABC Analysis- Stock Control

- Another application of Pareto analysis is in stock control where it may be found that only a few of the goods in stock make up most of the value. In practice, approximately 20% of the total quantity of stock may account for about 80% of its value. The outcome of such analysis is that by concentrating on small proportion of stock items that jointly accounts for 80% of the total value, a firm may well be able to control most of monetary investment in stocks.

Application in Activity Based Costing

- In Activity Based Costing it is often said that 20% of an organisation cost drivers are responsible for 80% of the total cost. By analysing, monitoring and controlling those cost drivers that cause most cost, a better control and understanding of overheads will be obtained.

Quality Control

- Pareto analysis seeks to discover from an analysis of defect report or customer complaints which "vital few" causes are responsible for most of the reported problems.
- Often, 80% of reported problems can usually be traced to 20% of the various underlying causes. By concentrating once efforts on rectifying the vital 20%, one can have the greatest immediate impact on product quality.
- The Pareto Analysis indicates how frequently each type of failure (defect) occurs. The purpose of the analysis is to direct management attention to the area where the best returns can be achieved by solving most of quality problems, perhaps just with a single action.

Illustration

The following information is given about the type of defects during a production period and the frequencies of their occurrence in a spectacle manufacturing company:

Defect	No. of items
End Frame not equidistant from the centre	10
Non-uniform grinding of lenses	60
Power mismatches	20
Scratches on the surface	110
Spots / Stains on lenses	5
Rough edges of lenses	70
Frame colours-shade differences	25

Required

PREPARE a frequency table so that a Pareto Chart can be constructed for the defect type. Also, IDENTIFY key areas of focus.

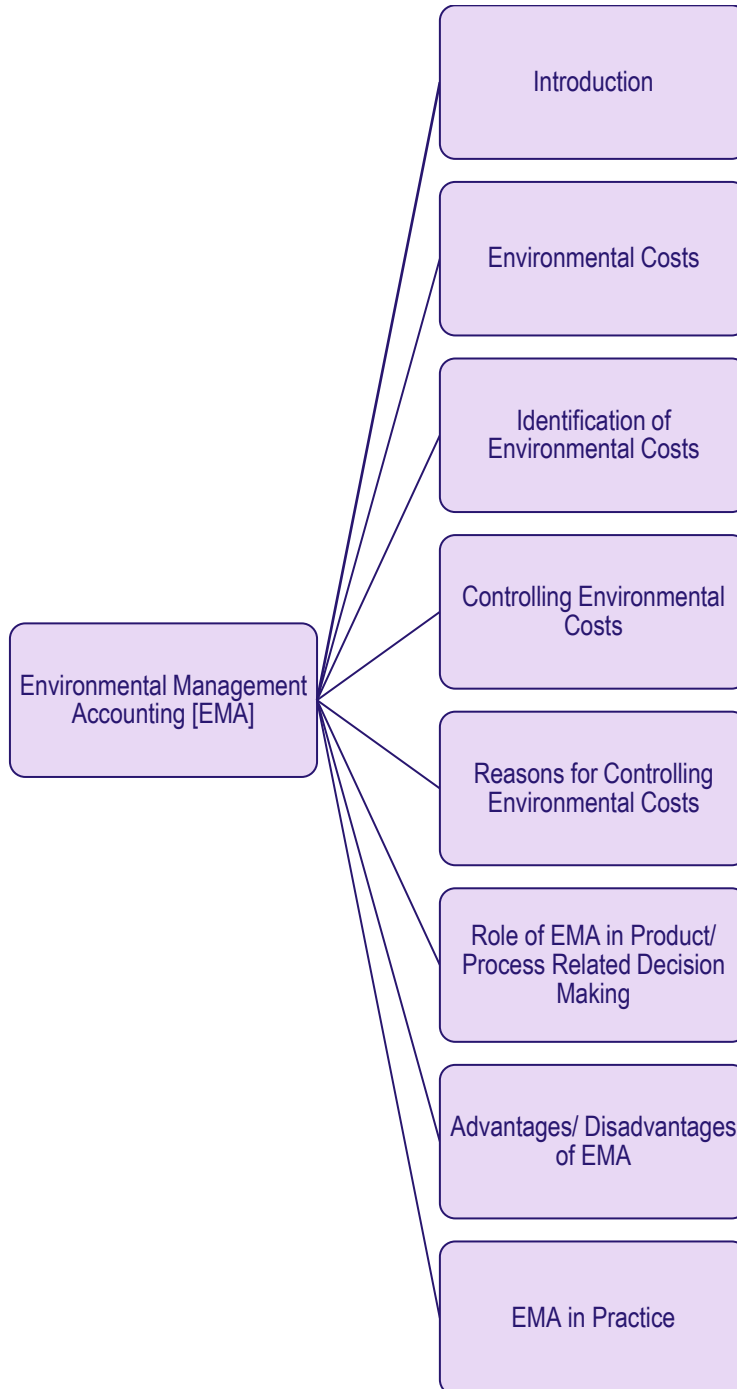
Solution**Statement Showing "Pareto Analysis of Defects"**

Defect Type	No. of Items	% of Total Items	Cumulative Total
Scratches on the surface	110	36.67%	36.67%
Rough edges of lenses	70	23.33%	60.00%
Non-uniform grinding of lenses	60	20.00%	80.00%
Frame colours-shade differences	25	8.33%	88.33%
Power mismatches	20	6.67%	95.00%
End frame not equidistant from the centre	10	3.33%	98.33%
Spots/ Strain on lenses	5	1.67%	100.00%
	300	100.00%	

The company should focus on eliminating scratches on the surface, rough edges of lenses and grinding of lenses related defects which constitute 80% portion, according to Pareto Theory.



ENVIRONMENTAL MANAGEMENT ACCOUNTING [EMA]



EMA is the process of collection and analysis of the information relating to environmental cost for internal decision making. EMA identifies and estimates the costs of environment-related activities and seeks to control these costs. The focus of EMA is not on financial costs but it also considers the environmental cost or benefit of any decisions made. EMA is an attempt to integrate best management accounting thinking with best environmental management practice.

EMA can be viewed as a part of the environmental accounting framework and is defined as using monetary and physical information for internal management use. Though EMA information can be used in any management decision making process, it is particularly useful for environmental decision making. EMA aims to make a better use of or to modify sources of information and management accounting techniques and to evaluate sustainability and/or environmental efficiency of a company.

The major areas for the application for EMA are:

- Product Pricing
- Budgeting
- Investment Appraisal
- Calculating Costs and
- Savings of Environmental Projects, or Setting Quantified Performance Targets.

Environmental Costs

The US Environmental Protection Agency in 1998 has categorized Environmental Costs in four sections:

- *Conventional Costs*: Raw material and energy costs having environmental relevance.
- *Hidden Costs*: Costs which have been accounted for but then lose their identity in 'general overheads'.
- *Contingent Costs*: Costs to be incurred at a future date – for example, clean- up costs.
- *Relationship Costs*: Intangible Costs, for example, the costs of preparing environmental reports.

The United Nations Division for Sustainable Development (UNSD), on the other hand, described Environmental Costs as comprising of:

- Costs incurred to protect the environment – for example, measures taken to prevent pollution, and
- Costs of wasted material, capital and labor, i.e. inefficiencies in the production process.

Neither of these definitions contradicts each other; they just look at the costs from slightly different angles.

In practice, Environmental Costs can be split into further two categories: Internal Costs and External Costs. *Internal Costs* have direct impact on the income statement of a company. On the other hand, *External Costs* are imposed on society at large, but not borne by the company that generates the cost in the first instance. Recently governments of many countries are becoming increasingly aware of these external costs and are using taxes and regulations to convert them to internal costs. For example, if the activities of companies lead to forest degradation they might be required to have a tree replacement programme, or they may be granted lower tax allowances on vehicles that cause a high degree of harm to the environment.

Hansen and Mendoza (1999) point out that environmental costs are incurred because of poor quality controls. They advocate the use of a periodical environmental cost report, based on the principles of *cost of quality report*, with each category of cost being expressed as a percentage of sales revenues or operating costs so that comparisons can be made between different periods and/or organisations. The categories of costs would be as follows:

- Environmental Prevention Costs– Those costs associated with *preventing* adverse environmental impacts. Examples include
 - Evaluating and picking pollution control equipment
 - Creating environmental policies
 - Environmentally driven R & D
 - Site and feasibility studies
 - Investment in protective equipment
- Environmental Appraisal Costs– The cost of activities executed to determine whether products, process and activities are in *compliance* with environmental standards, policies and laws. Examples include
 - Monitoring, testing, inspection and reporting
 - Improved systems and checks in order to prevent fines/ penalties
 - Regulatory compliances
 - Performing contamination tests
 - Audit of environmental activities
- Environmental Internal Failure Costs – Costs incurred from activities that have been produced but *not discharged* into the environment. Examples include
 - Recycling scrap
 - Disposing toxic material
 - Back end costs such as decommissioning costs on project completion
- Environmental External Failure Costs – Costs incurred on activities performed *after discharging* waste into the environment. These costs have adverse impact on the organisation's *reputation* and *natural resources*. Examples include
 - Cleaning up contaminated soil.
 - Restoring land to its natural state

The environmental cost report should be similar in format to the cost of quality report. Some companies have started linking their environmental strategy to concrete performance measures via **balanced scorecard framework**.

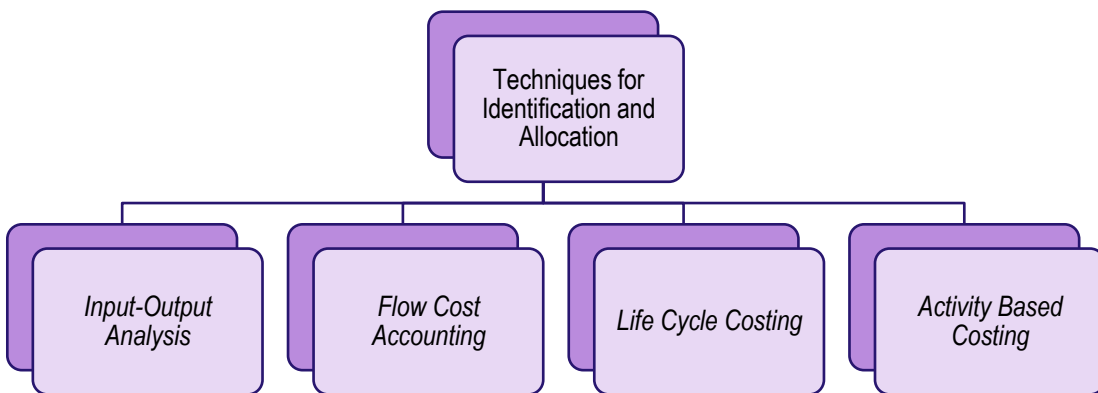
(Source: *Management Accounting for Business* By Colin Drury)

Identification of Environmental Costs

To prepare environmental management accounts an intense review of general ledger containing costs of materials, utilities and waste disposal etc. is required. Since the *environmental costs are generally 'hidden' in 'general overheads' of the company*, it becomes difficult for management to identify opportunities to cut environmental costs but nonetheless it is crucial for them to do so to preserve natural resources getting scarcer.

Allocation of environmental costs to the processes or products which give rise to them is equally important for organisations in making well-informed business decisions. For example, a pharmaceutical company has to decide on the production of one of its drugs. In order to incorporate environmental aspects into its decision, it needs to know exactly how many products are input into the process compared to its outputs; how much waste is created during the process; how much labour and fuel is used in making the drug; how much packaging the drug uses and what percentage of that is recyclable etc. Only by identifying these costs and allocating them to the product can an informed decision be made about the environmental effects of continued production.

In 2003, the UNDSO identified four management accounting techniques for the Identification and Allocation of Environmental Costs:



Input-Output Analysis

This technique records material inflows and balances this with outflows on the basis that, what comes in, must go out. So, if 100kg of materials have been bought and only 80kg of materials have been produced, for example, then the 20kg difference must be accounted for in some way. It may be, for example, that 10% of it has been sold as scrap and 90% of it is waste. By accounting for outputs in this way, both in terms of physical quantities and, at the end of the process, in monetary terms too, businesses are forced to focus on environmental costs.

Flow Cost Accounting

This technique uses not only material flows but also the organizational structure. Classic material flows are recorded as well as material losses incurred at various stages of production. Flow cost accounting makes material flows transparent by using various data, which are quantities (physical data), costs (monetary data) and values (quantities x costs). The material flows are divided into three categories, material, system, and delivery and disposal.

The *material* values and costs apply to the materials which are involved in the various processes. The *system* values and costs are the in-house handling costs, which are '...incurred inside the company for the purpose of maintaining and supporting material throughput, e.g. personnel costs or depreciation,' (UNSD, 2003).

The *delivery and disposal* values and costs refer to the costs of flows leaving the company, for example transport costs or cost of disposing waste. EMA can benefit from flow cost accounting because it aims to reduce the quantities of materials, which leads to increased ecological efficiency (UNSD, 2003).

Life Cycle Costing

Lifecycle costing considers the costs and revenues of a product over its whole life rather than one accounting period. Therefore, the full environmental cost of producing a product will be taken into account. In order to reduce lifecycle costs an organization may adopt a TQM approach.

It is arguable that TQM and environmental management accounting are inextricably linked insofar as good environmental management is increasingly recognized as an essential component of TQM. Such organizations pursue objectives that may include zero complaints, zero spills, zero pollution, zero waste and zero accidents. Information systems need to be able to support such environmental objectives via the provision of feedback - on the success or otherwise - of the organizational efforts in achieving such objectives.

Activity Based Costing (ABC)

ABC allocates internal costs to cost centres and cost drivers on the basis of the activities that give rise to the costs. In an environmental accounting context, it distinguishes between **environment-related costs**, which can be attributed to joint cost centres, and **environment-driven costs**, which tend to be hidden on general overheads.

The environment-driven costs are removed from general overheads and traced to products or services. The cost drivers are determined based on environment impact that activities have and costs are charged accordingly. This should give a good attribution of environmental costs to individual products and should result in better control of costs.

Schaltegger and Muller (1998) stated 'the choice of an adequate allocation key is crucial for obtaining correct information'. The four main allocation keys are:

- Volume of emissions or waste
- Toxicity of emission and waste treated
- Environmental impact added (volume x input per unit of volume) volume of the emissions treated and
- The relative costs of treating different kinds of emissions.

Controlling Environmental Costs

After Identification and Allocation of Environmental Costs, task of controlling starts. Suppose ABC Ltd.'s main *environmental costs* are as follows:

- Water consumption
- Energy

- Transport and travel
- Consumables and raw materials.

An organization may try to control these cost as mentioned below-

Waste

'Mass balance' approach can be used to determine how much material is wasted in production, whereby the weight of *materials bought is compared to the product yield*. From this process, potential cost savings may be identified. In addition to these monetary costs to the organization, waste has environmental costs in terms of lost land resources (because waste has been buried) and the generation of greenhouse gases in the form of methane. Costs of unused raw materials and disposal; taxes for landfill; fines for compliance failures such as pollution are considered as environmental cost associated with waste.

Water

Businesses pay for water twice – first, to buy it and second, to dispose of it. If savings are to be made in terms of reduced water bills, it is important for organizations to identify where water is used and how consumption can be decreased.

Energy

Often, energy costs can be reduced significantly at very little cost. Environmental management accounts may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings.

Transport and Travel

Again, EMA techniques may be used to identify savings in terms of travel and transport of goods and materials. At a simple level, a business can invest in more fuel-efficient vehicles, for example.

Consumables and Raw Materials

These are directly attributable costs and discussions with management can reduce such costs. For example, toner cartridges for printers could be refilled rather than replaced.

This should produce a saving both in terms of the financial cost for the organization and a waste saving for the environment (toner cartridges are difficult to dispose of and less waste is created this way).

Case Scenario

CNB Oil Ltd., an Indian oil company, is the leading manufacturer of all streams of oil and engaged in refining (processing capacity 50 MMTA of crude oil), pipeline transportation and marketing of petroleum products to research & development, exploration & production, marketing of natural gas and petrochemicals. The company has high-caliber employees, sophisticated technologies and leading-edge R&D. By venturing itself into the renewables and the nuclear energy, CNB has grown and evolved itself from a pure petroleum refining and marketing company to a full-fledged energy company. Due to government's new environmental policy, environmental report is mandatorily required to be submitted yearly for the prescribed industries polluting environment substantially otherwise would be penalized. Energy sector also falls in these prescribed industries. CNB has already taken initiatives to control air pollution and

water pollution like use of low sulphur fuel oil in boilers and heaters & NOx burners to minimize gas emission, network of underground sewers for segregated collection of various wastewater streams for waste water management, however while preparing and analyzing environmental report, Mr. K V Sharma, CEO, is not happy with high environmental cost in terms of Waste (oily / chemical / biological sludge, scrape batteries, e-waste, chemical containers, effluents etc.), Raw Material Consumption, Water Consumption, Energy and Transportation. He raised his concern with Board of Directors and they have decided to appoint you as an environmental management accounting expert to manage environmental cost.

Required

APPLY Environmental Management Accounting in CNB to manage environmental costs.

Solution

Environmental Management Accounting (EMA) is the process of collection and analysis of the information relating to environmental cost for internal decision making. EMA identifies and estimates the cost of environment related activities and seek to control these cost.

In CNB, during refinery operations, waste water, fugitive emissions, flue gases and solid wastes are generated. Due to this excess waste and gas emission, environmental cost rises. Scarce natural resources should be used in such a way so that their consumption is sustainably optimized. In order to cutback environmental cost, EMA can be applied as follows:

Waste

CNB should measure, manage and monitor waste from operations in order to minimise impact on people and the environment. 'Mass balance' approach can be used to determine how much material is wasted in production, whereby the weight of materials bought is compared to the product yield. From this process, potential cost savings may be identified.

In CNB, wastes are oily / chemical / biological sludge, scrape batteries, e-waste, chemical containers, effluent etc. Waste generated in operations is either treated within the premise or disposed through approved waste treatment, storage, and disposal facility. To avoid the usage of chemical drums/ containers in large quantity, separate storage tanks can be created for bulk storage of additives to reduce the drum procurement and disposal.

Further, refineries in operation should be upgraded from time to time to minimize waste.

Water Management

Businesses pay for water twice – first, to buy it and second, to dispose of it. If savings are to be made in terms of reduced water bills, it is important for CNB to identify where water is used and how consumption can be decreased.

For water conservation, sustainable water management techniques should be adopted. In refining operation, water is mainly used in boilers and cooling units. Collective efforts should be made to optimize water consumption and maximum reuse of used water. Advanced treatment system like rain water harvesting, ultra-filtration, reverse osmosis etc. may be used for water purification for further use. This would lead to substantial reduction in intake of fresh water.

In addition, CNB staff should be alerted for water conservation through seminars, presentations, conference, awareness campaigns.

Energy

Often, energy costs can be reduced significantly at very little cost. Environmental Management Accounts may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings. Some of energy conservation initiatives may be taken by CNB like:

- Conducting periodic energy audits for identifying energy saving opportunities.
- Phasing out conventional lights and replacement with LED lights/induction lights.
- Power factor improvement by installation of capacitor banks.
- Installation of 5 star rated energy equipment.
- Prevention of idle running of equipment.
- Installation of solar lights.
- Use of Nano molecular thermal additives in ACs.
- Installation of efficient energy monitoring system for energy intensive equipment.
- Capacity improvement for batteries.

Consumables and Raw Material

Refineries 'refine' crude oil in massive quantities, to produce the fuels need. There should be continuously monitoring on optimum utilization of crude oil to improve gross refining margin. The gross refining margin is the difference between the total value of petroleum products coming out of an oil refinery (output) and the price of the raw material, (input) which is crude oil. Even not only crude oil there should also be optimum and sustainable utilization of resources like additives, chemicals etc. from procurement to production stages.

CNB may use recyclable technology for raw material and consumable wastages which provides sustainability in terms of environmental protection and reduction in carbon footprint. Periodic testing should be performed to assess the health of equipment and pipelines as to have better process of raw materials and consumables.

Transport

Again, EMA may be used to identify saving in terms of transport of goods and materials. At CNB, in order to cutback emission and fuel consumption due to transportation, route optimization activity may be used like allocation of customer on the basis of nearest depots and locations as to reduce distance, real time fleet tracking using GPS (to make sure that vehicles do not deviate from assigned shortest route) etc.

Reasons for Controlling Environmental Cost

There are three main reasons why the management of environmental costs is becoming increasingly important in organizations.

First, a 'carbon footprint' (as defined by the Carbon Trust) measures the total greenhouse gas emissions caused directly and indirectly by a person, organization, event or product. People are now becoming aware about the 'carbon footprint' and recycling. Several companies have initiated CSR committees as they feel that portraying themselves as environmentally responsible makes them popular among consumers.

Second, environmental costs are becoming huge for some companies, particularly those operating in highly industrialized sectors such as oil production. In some cases, these costs can amount to more than 20% of operating costs. Such significant costs need to be managed.

Third, regulation is increasing worldwide at a rapid pace, with penalties for non-compliance also increasing accordingly. In the largest ever seizure related to an environmental conviction in the UK, a plant hire firm, John Craxford Plant Hire Ltd, had to not only pay £85,000 in costs and fines but also got £1.2m of its assets seized. This company had illegally buried waste and breached its waste and pollution permits. And it's not just the companies that need to worry. Every person found guilty of breaching environmental regulations knowingly are liable to criminal prosecution as per the regulatory laws.

The management of environmental costs is not an easy process. This is because first, just as EMA is difficult to define, so too are the actual costs involved. Second, having defined them, some of the costs are difficult to separate out and identify. Third, the costs can need to be controlled but this can only be done if they have been correctly identified in the first place.

Role of EMA in Product/ Process Related Decision Making

The correct costing of products is a pre-condition for making sound business decisions. The accurate product pricing is needed for strategic decisions regarding the volume and choices of products to be produced. *EMA converts many environmental overhead costs into direct costs and allocate them to the products that are responsible for their incurrence.* The results of improved costing by EMA may include:

- Different pricing of products as a result of re-calculated costs;
- Re-evaluation of the profit margins of products;
- Phasing-out certain products when the change is dramatic;
- Re-designing processes or products in order to reduce environmental costs and
- Improving housekeeping and monitoring of environmental performance.

Advantages of EMA

Improving Revenue

Production of new products or services meeting the environmental needs or concerns of customers can lead to increased sales. It may also be possible to sell such products for a premium price. Improved sales may also be a consequence of improving the reputation of the business.

It is possible that in the future, rather than good environmental management resulting in improved sales, poor management will lead to losses. All businesses will be expected to meet a minimum standard related to environmental issues.

Cost Reductions

Paying close attention to the use of resources can lead to reductions in cost. Often simple improvements in processes can lead to significant costs savings.

Disadvantages of EMA

Increases in Costs

Cost of complying with legal and regulatory requirements, and additional costs to improve the environmental image of the organization may result in increase in some costs. However, some of these costs may be offset by government grants and this expenditure may save money in the long-term as measures taken may prevent future losses.

Costs of Failure

Significant costs may be incurred if there is poor environmental management. Thus, the cost of clean-up and fines on violation of any government environmental policy may be huge.

Conclusion

The main difficulty associated with EMA is the identification and allocation of environmental costs. Due to this, Management Accounting Techniques can distort and misrepresent environmental issues, leading to managers making decisions that are bad for businesses and bad for the environment. Environmental issues need to be managed before they can be reported on, and this requires changes to management accounting systems as poor environmental behaviour may have a real adverse impact on the business and its finances. Punishment includes fines, increased liability to environmental taxes, loss in value of land, destruction of brand values, loss of sales, consumer boycotts and inability to secure finance, loss of insurance cover, contingent liabilities, law suits, and damage to corporate image.

EMA in Practice

Xerox Limited

Xerox Limited, a subsidiary of Xerox Corporation, introduced the concept of lifecycle costing for its logistic chain. Manufacturing photocopiers is the core business of Xerox. The photocopiers are leased rather than sold. This means the machines are returned to Xerox limited at the end of their lease. Previously, machines were shipped in a range of different types of packaging, which could rarely be re-used by customers to return the old copiers. The customer had to dispose of the original packaging and to provide new packaging to return the machine at the end of its lease, which in turn could not be used to re-ship other machines. So, Xerox ultimately lost the original costs and even had to bear the additional costs of disposal of the new packaging. A new system was invented which used a standard pack (tote). Two types of totes were introduced to suit the entire range of products sold by Xerox. Totes can be used for both new machines delivery and return carcasses. The whole-chain cost analysis showed the considerably lower cost of the tote system, compared to the previously existing system and the supply chain became more visible. The tote system resulted not only in cost savings but also in reduced 'de-pack' times and improved customer relations (Bennett and James, 1998b).



SUMMARY

- Cost Reduction and Cost Control– Cost Control involves a comparison of actual with the standards or budgets, to regulate the actual costs. Cost Reduction is the achievement of real and permanent reduction in unit cost of products manufactured.
- Scope of Cost Reduction– Cost Reduction efforts can be put in the following areas- a) Product Design, b) Organisation, c) Factory lay-out Equipment, d) Production Plan Programme and Method. It may be extended to administrative, selling and distribution methods, personnel management, purchase and material control, financial management, and other services.
- Target Costing– A structured approach to determining the cost at which a proposed product with specified functionality and quality must be produced, to generate a desired level of profitability at its anticipated selling price.

In Target costing, we first determine what price we think the consumer will pay for our product. We then determine how much of a profit margin we expect and subtract that from the final price. The remaining amount left is what is available as a budget to be used to create the product.

- Advantages of Target Costing– Proactive approach, top-to-bottom commitment to process and product innovation, helps to create a company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success, control systems to support and reinforce manufacturing strategies and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lowest cost, proper planning, enhances employee awareness and empowerment, partnership with suppliers, Minimize non-value-added activities, lowest cost value added activities, reduced time to market.
- Main Features of Target Costing System– Integral part of the design and introduction of new products, target selling price determined using various sales forecasting techniques, target selling price helps in establishment of target production volumes, given the relationship between price and volume, helps in establishing cost reduction targets, fair degree of judgement is needed where the allowable cost and the target cost differ, a series of intense activities required to translate the cost challenge into reality.
- Components of Target Costing System–

Value Analysis is a planned, scientific approach to cost reduction which reviews the material composition of a product and production design so that modifications and improvements can be made which do not reduce the value of the product to the customer or to the user.

Value Engineering is the application of value analysis to new products. Value engineering relates closely to target costing as it is cost avoidance or cost reduction before production.

The initial value engineering may not uncover all possible cost savings. Thus, Kaizen Costing is designed to repeat many of the value engineering steps for as long as a product is produced, constantly refining the process and thereby stripping out extra costs.

Further, Target Costing System is based on involving representatives of all the Value Chain such as suppliers, agents, distributors and existing after-sales service in the target costing system.

Issues dealt with during a Value Analysis/ Value Engineering review

- Can we eliminate functions from the production process?
- Can we eliminate some durability or reliability?
- Can we minimize the design?
- Can we design the product better for the manufacturing process?
- Can we substitute parts?
- Can we combine steps?
- Can we take supplier's assistance?
- Is there a better way?

A mix of all the value engineering steps noted above must be applied to each product design to ensure that the maximum permissible cost is safely reached.

- Problems with Target Costing– Development process can be lengthened to a considerable extent, large amount of mandatory cost cutting can result in finger-pointing in various parts of the company, difficult to reach a consensus on the proper design, requires the development of detailed cost data, reduce the quality of products due to the use of cheap components which may be of inferior quality, requirement of a good team leader.
- Most Useful Situations for Target Costing– Assembly-oriented industries, diversified product lines, factory automation through use of technologies, having shorter product life cycles, implementing JIT, value engineering, etc.
- Implementing a Target Costing System– Create a Project Charter, Obtain a Management Sponsor, Obtain a Budget, Assign a Strong Team Manager, Enroll Full-Time Participants, Use Project Management Tools, Fullest possible support for target costing by all available means—management, money and staff. Only when all these elements are in place and concentrated on the goals at hand does a target costing program have the greatest chance for success.
- Pareto Analysis– Pareto Analysis is a rule that recommends focus on the most important aspects of the decision making in order to simplify the process of decision making. It is based on the 80: 20 rule where it is believed that 80% of the profits of an organisation relates to 20% of the customers. It helps to clearly establish top priorities and to identify both profitable and unprofitable targets.
- Usefulness of Pareto Analysis– Prioritize problems, goals, and objectives to identify root causes, define key quality improvement programs, Select key customer relations and service programs, employee relations improvement programs, and key performance improvement programs, proper allocation of physical, financial, and human resources.

- Application of Pareto Analysis– Pricing of a Product, Customer Profitability Analysis, ABC Analysis- Stock Control, Application in Activity Based Costing.
- Life Cycle Costing– Life Cycle Costing involves identifying the costs and revenue over a product's life i.e. from inception to decline. The life cycle of a product consists of four stages viz., Introduction; Growth; Maturity; Saturation and Decline.
- Benefits of Product Life Cycle Costing– Results in earlier actions to generate revenue or to lower costs than otherwise might be considered, more accurate and realistic assessment of revenues and costs, promote long-term rewarding in contrast to short-term profitability rewarding, provides an overall framework for considering total incremental costs over the entire life span of a product, provides long-term picture of product line profitability, enhance the control of manufacturing costs, traces research and design and development costs etc.
- Environmental Management Accounting [EMA] – EMA is the process of collection and analysis of the information relating to environmental cost for internal decision making. EMA identifies and estimates the costs of environment-related activities and seeks to control these costs. The focus of EMA is not on financial costs but it also considers the environmental cost or benefit of any decisions made.
- The major areas for the application for EMA are: Product Pricing, Budgeting, Investment Appraisal, Calculating Costs and Savings of Environmental Projects, or Setting Quantified Performance Targets.
- Environmental Costs–
 - Environmental Prevention Costs-* Pollution Control Equipment, Environmental Policy Formulation, etc.
 - Environmental Appraisal Costs-* Monitoring, Testing and Inspection Costs, Reporting Costs, etc.
 - Environmental Internal Failure Costs-* Cost of Recycling or Disposing of Waste or Harmful Materials, Decommissioning Costs on Project Completion, etc. *Environmental External Failure Costs-* Carbon Emissions and the Adverse Impact these have on the Global Climate.
- Identification of Environmental Costs– Four management accounting techniques for the Identification and Allocation of Environmental Costs are - Input/Outflow Analysis, Flow Cost Accounting, Activity Based Costing and Lifecycle Costing.
 - Input-Output Analysis-*

This technique records material inflows and balances this with outflows on the basis that, what comes in, must go out. By accounting for outputs in this way, both in terms of physical quantities and, at the end of the process, in monetary terms too, businesses are forced to focus on environmental costs.
 - Flow Cost Accounting-*

Classic material flows are recorded as well as material losses incurred at various stages of production.

Life Cycle Costing-

Lifecycle costing considers the costs and revenues of a product over its whole life rather than one accounting period. Therefore, the full environmental cost of producing a product will be taken into account.

Activity Based Costing (ABC) –

ABC distinguishes between environment-related costs, which can be attributed to joint cost centres, and environment- driven costs, which tend to be hidden on general overheads.

- Need to manage Environmental Costs– A ‘carbon footprint’ (as defined by the Carbon Trust) measures the total greenhouse gas emissions caused directly and indirectly by a person, organization, event or product, environmental costs are becoming huge and Such significant costs need to be managed, regulation is increasing worldwide at a rapid pace, with penalties for non-compliance also increasing accordingly.
- Advantages of EMA– Improved Revenues (Production of new products or services meeting the environmental needs or concerns of customers can lead to increased sales) and Cost Reductions (Simple improvements in processes can lead to significant costs savings).
- Disadvantages of EMA– Increases in Costs for legal and regulatory requirements, Costs of Failure if there is poor environmental management.



TEST YOUR KNOWLEDGE

Target Costing

1. Storewell Industries Ltd. manufactures standard heavy duty steel storage racks for industrial use. Each storage rack is sold for ₹750 each. The company produces 10,000 racks per annum. Relevant cost data per annum are as follows:

Cost Component	Budget	Actual	Actual Cost p.a. (₹)
Direct Material	5,00,000 sq. ft.	5,20,000 sq. ft.	20,00,000
Direct Labour	90,000 hrs.	1,00,000 hrs.	10,00,000
Machine Setup	15,000 hrs.	15,000 hrs.	1,50,000
Mechanical Assembly	200,000 hrs.	200,000 hrs.	30,00,000

The actual and budgeted operating levels are the same. Actual and standard rates of material procurement and hourly labor rate are also the same. Any variance in cost is solely on account of difference in the material usage and hours required to complete production. Aggressive pricing from competitors has driven down sales. A comparable rack is available in the market for ₹675 each. Vishal, the marketing manager has determined that in order to maintain the company’s existing market share of 10,000 racks, Storewell Industries must reduce the price of each rack to ₹675.

Required

- (i) CALCULATE the current cost and profit per unit. IDENTIFY the non-value added activities in the production process.
 - (ii) CALCULATE the new target cost per unit for a sales price of ₹675 if the profit per unit is maintained.
 - (iii) RECOMMEND what strategy Storewell Industries should adopt to attain target cost calculated in (ii) above.
2. NEC Ltd., forms a Committee consisting of its Production, Marketing, and Finance Directors to prepare a budget for the next year. The Committee submits a draft budget as detailed below:

Particulars	₹
Selling Price <i>per unit</i>	50
<i>Less: Direct Material Cost per unit</i>	9
Direct Labour Cost <i>per unit</i>	9
Variable Overhead <i>per unit</i> (3 hrs. @ ₹2)	6
Contribution <i>per unit</i>	26
Budgeted Sales Quantity	25,000 units
Budgeted Contribution (25,000 × ₹26)	6,50,000
<i>Less: Budgeted Fixed Cost</i>	5,00,000
Budgeted Profit	1,50,000

The Management is not happy with the budgeted profit as it is almost equal to the previous year's profit. Therefore, it asks the Committee to prepare a budget to earn at least a profit of ₹3,00,000. To achieve the target profit, the Committee reports back with the following suggestions:

The unit selling price should be raised to ₹55.

The sales volume should be increased by 5,000 units.

To attain the above said increase in sales, the company should spend ₹40,000 for advertising.

The production time per unit should be reduced.

To win the acceptance of the workers in this regard the hourly rate should be increased by ₹3 besides an annual group bonus of ₹30,000.

There is no change in the amount and rates of other expenses. The company has sufficient production capacity.

As the implementation of the above proposal needs the acceptance of the work force to increase the speed of work and to reduce the production time per unit, the Board wants to know the extent of reduction in per unit production time.

Required

- (i) CALCULATE the target production time per unit and the time to be reduced per unit.
- (ii) IDENTIFY the other problems that may arise in production due to decrease in unit production time and also suggest the remedial measures to be taken.
- (iii) STATE the most suitable situation for the adoption of Target Costing.

Pareto Analysis

3. Generation 2050 Technologies Ltd. develops cutting-edge innovations that are powering the next revolution in mobility and has nine tablet smart phone models currently in the market whose previous year financial data is given below:

Model	Sales (₹'000)	Profit-Volume (PV) Ratio
Tab - A001	5,100	3.53%
Tab - B002	3,000	23.00%
Tab - C003	2,100	14.29%
Tab - D004	1,800	14.17%
Tab - E005	1,050	41.43%
Tab - F006	750	26.00%
Tab - G007	450	26.67%
Tab - H008	225	6.67%
Tab - I009	75	60.00%

Required

- (i) Using the financial data, carry out a Pareto ANALYSIS (80/20 rule) of Sales and Contribution.
- (ii) DISCUSS your findings with appropriate RECOMMENDATIONS.

Life Cycle Costing

4. P & G International Ltd. (PGIL) has developed a new product 'α³' which is about to be launched into the market. Company has spent ₹30,00,000 on R&D of product 'α³'. It has also bought a machine to produce the product 'α³' costing ₹11,25,000 with a capacity of producing 1,100 units per week. Machine has no residual value. The company has decided to charge price that will change with the cumulative numbers of units sold:

Cumulative Sales (units)	Selling Price ₹ per unit
0 to 2,200	750
2,201 to 7,700	600
7,701 to 15,950	525
15,951 to 59,950	450
59,951 and above	300

Based on these selling prices, it is expected that sales demand will be as shown below:

Weeks	Sales Demand per week (units)
1-10	220
11-20	550
21-30	825
31-70	1,100
71-80	880
81-90	660
91-100	440
101-110	220
Thereafter	NIL

Unit variable costs are expected to be as follows:

₹ per unit	
First 2,200 units	375
Next 13,750 units	300
Next 22,000 units	225
Next 22,000 units	188
Thereafter	225

PGIL uses just-in-time production system. Following is the total contribution statement of the product 'α³' for its Introduction and Growth stage:

Weeks	Introduction	Growth	
	1 - 10	11 - 30	
Number of units Produced and Sold	2,200	5,500	8,250
Selling Price per unit (₹)	750	600	525
Variable Cost per unit (₹)	375	300	300
Contribution per unit (₹)	375	300	225
Total Contribution (₹)	8,25,000	16,50,000	18,56,250

Required

- (i) PREPARE the total contribution statement for each of the remaining two stages of the product's life cycle.
- (ii) DISCUSS Pricing Strategy of the product 'α³'.
- (iii) FIND possible reasons for the changes in cost during the life cycle of the product 'α³'.

Note: Ignore the time value of money.

5. JFE, is following Life Cycle Costing. Its four products P₄, P₃, P₂ and P₁ are in the market respectively in Introduction, Growth, Maturity, and Decline stages (phases). The Management wants to analyse the marketing challenges faced by the products to take strategical measures to stabilise the products in the market. For this purpose, the Board directed the Secretary to get a product-wise report from the marketing chief of each product. The chiefs were asked to give one characteristic possessed by the product because of which the product is being classified in the respective stage and two strategical measures to be taken to overcome the market challenges faced at that stage (phase). The Secretary received the report from all the chiefs and handed them over to the computer operator to get it printed in a tabulated form. But the operator, without understanding the significance of the products, phases, characteristics, and strategies, mixed all the twelve items [(1 + 2) × 4] and got it printed as a list as given below:

- (1) Over capacity in the industry.
- (2) The company can continue to offer the product to our loyal customers at a reduced price.
- (3) Few competitors produce basic version of our product.
- (4) Product features may be improved or enhanced to differentiate our product from that of the competitors.
- (5) Attracting customers by raising awareness about our product through promotion activities.
- (6) High volume of business and increase in competition.
- (7) Use the present product as replacement product for launching another new product successfully in the market.
- (8) Value-based pricing strategies may be considered.
- (9) Profits start declining and at times become negative.
- (10) Maintain control over product quality to assure customer satisfaction.
- (11) Strengthening or expanding channel and supply chain relationships.
- (12) Prices may have to be reduced to attract the price-sensitive customers.

The items are required to be tabulated as in the format given below:

Required

- (i) Complete the table given below by entering the twelve items under appropriate category columns. You need not rewrite the items. Write the serial numbers of the items only in columns (3) and (4).

Products (1)	Phases (Stages) (2)	Characteristics (3)	Strategies (4)
P ₄	Introduction		
P ₃	Growth		
P ₂	Maturity		
P ₁	Decline		

- (ii) List down the importance (any four) of Product Life Cycle Costing.
 (iii) State the benefits (any four) of Product Life-Cycle Costing.

Environmental Management Accounting

6. A fertilizer company produces Grade A and Grade B fertilizers. One kilogram of Grade A fertilizer sells for ₹280 per kilogram and one kilogram of Grade B fertilizer sells for ₹400 per kilogram.

The products pass through three cost centers CC1, CC2 and CC3 during the manufacturing process. Total direct material cost per kilogram of fertilizer produced is ₹300 and direct labor cost per kilogram of fertilizer produced is ₹200. Allocation between the cost centres is given below:

Particulars	CC1	CC2	CC3	Total
Cost of Direct Material (per kg of fertilizer produced)	₹90	₹120	₹90	₹300
Cost of Direct Labour (per kg of fertilizer produced)	₹60	₹80	₹60	₹200
Cost Allocation to Grade A	30%	50%	30%	
Cost Allocation to Grade B	70%	50%	70%	

All of expenses (considered to be overheads) per kilogram of fertilizer produced is ₹150. This is allocated equally between Grade A and Grade B fertilizer. Pricing decisions for the fertilizers is made based on the above cost allocation.

The management accountant of the company has recently come across the concept of environmental management accounting. Pricing of products should also factor in the environmental cost generated by each product. An analysis of the overhead expenses revealed that the total cost of ₹150 per kilogram of fertilizer produced, includes incinerator costs of ₹90 per kilogram of fertilizer produced. The incinerator is used to dispose the solid

waste produced during the manufacturing process. Below is the cost center and product wise information of solid waste produced:

Waste produced (in tonnes per annum)	CC1	CC2	CC3	Total
Grade A	2	3	1	6
Grade B	2	2	5	9

Based in the impact that each product has on the environment, the management would like to revise the cost allocation to products based taking into account the incinerator cost that each product generates. The remaining overhead expenses of ₹60 per kilogram of fertilizer produced can be allocated equally.

Required

- (i) CALCULATE product wise profitability based on the original cost allocation. RECALCULATE the product wise profitability based on activity based costing methodology (environmental management accounting).
- (ii) ANALYZE difference in product profitability as per both the methods.
- (iii) RECOMMEND key takeaways for the company to undertake the above analysis of overhead costs and pricing as per environmental management accounting.



ANSWERS/ SOLUTIONS

1. (i) The current cost and profit per unit are calculated as below:

Cost Component	Units	Actual Cost p.a. for 10,000 racks (₹)	Actual Cost per rack (₹)
Revenue	10,000 racks	75,00,000	750
Direct Material	5,20,000 sq. ft.	20,00,000	200
Direct Labour	1,00,000 hrs.	10,00,000	100
Machine Setup	15,000 hrs.	1,50,000	15
Mechanical Assembly	200,000 hrs.	30,00,000	300
Total Cost		61,50,000	615
Profit		13,50,000	135

Therefore, the current cost is ₹615 p.u. while the profit is ₹135 p.u. Machine setup is the time required to get the machines and the assembly line ready for production. In this case, 15,000 hours spent on setting up does not add value to the storage racks directly. Hence, it is a non-value add activity.

- (ii) New sale price per rack is ₹675 per unit. The profit per unit needs to be maintained at ₹135 per unit. Hence, the new target cost per unit = new selling price per unit – required profit per unit = ₹675 - ₹135 = ₹540 per unit.

- (iii) As explained above, current cost per unit is ₹615 while the target cost per unit is ₹540. Hence, the cost has to be reduced at least by ₹75 per unit. Analysis of the cost data shows the variances between the budget and actual material usage and labor hours. It is given that the material procurement rate and labor hour rate is the same for budgets and actuals. Hence, the increment in cost of direct materials and labor is due to inefficient use of material and labor hours to complete the same level of production of 10,000 storage racks.

Corrective actions to address these inefficiencies could result in the following savings:

- (a) Inefficiencies resulted in use of extra 20,000 sq. ft. of material.

Material cost per sq. ft. = Actual cost / Actual material usage = ₹20,00,000 / 5,20,000 sq. ft. = ₹3.85 per sq. ft.

Therefore, inefficiencies resulted in extra cost = 20,000 sq. ft. × ₹3.85 per sq. ft. = ₹77,000.

If corrective action is taken, for 10,000 racks this translates to a saving of ₹7.70 per unit.

- (b) Inefficiencies resulted in extra 10,000 hrs. to be spent in production.

Labor cost per hr. = Actual cost / Actual labor hrs. = ₹10,00,000 / 10,000 hrs. = ₹10 per hr.

Therefore, inefficiencies resulted in extra cost = 10,000 hrs. × ₹10 per hour = ₹100,000.

If corrective action is taken, for 10,000 racks this translates to a saving of ₹10 per unit.

- (c) Machine setup cost is a non-value added cost. Value analysis can be done to determine if the setup time of 15,000 hrs. can be reduced. However, since these activities have been carried out for a reason, care should be taken to ensure that this change should not adversely impact the production activity later down the stream.

- (d) Mechanical assembly cost is almost half of the total cost. These are costs incurred during the production process on the assembly line. Value analysis can be done to determine if the production process can be made more efficient. For example, the process can be streamlined, such that steps can be combined that can be handled by fewer people (process centering). Similarly, value analysis / value engineering can focus on the product design.

Some questions to raise may be:

- Can the product be designed better to make the production more efficient?
- Can the design be minimized to include fewer parts and thus make it easier and efficient to manufacture?

- Can be substitute parts to make it more efficient? Or
- Is there simply a better way of producing the same product?

While target costing is a dynamic and corrective approach, care must be taken the product quality, characteristics and utility are maintained.

2. (i) Target Production Time *per unit*
- $$(\text{₹}3 + \text{₹}3 + \text{₹}2) \times \text{hrs.} \times 30,000 \text{ units} = \text{₹}5,10,000$$
- $$\text{Hrs.} = 2.125$$
- $$\text{Time to be reduced per unit} = 3 \text{ hrs.} - 2.125 \text{ hrs.}$$
- $$= 0.875 \text{ hrs.}$$

Workings

Statement Showing Target Cost (Direct Labour and Variable Overhead)

Particulars	Amount (₹)
Target Sales (₹55 × 30,000 units)	16,50,000
Less: Target Profit	3,00,000
Less: Direct Material Cost (₹9 × 30,000 units)	2,70,000
Less: Budgeted Fixed Costs	5,00,000
Less: Proposed Advertising	40,000
Less: Proposed Annual Group Bonus	30,000
Target Cost (Variable Overhead and Direct Labour) for 30,000 units	5,10,000

(ii) Problem

The target-costing method is applicable particularly for repetitive manufacturing. It should however be recognised that some products often bear a high degree of repetition and that there often are considerable repetitions where reduction targets could come into play as a framework for improving design. Working under pressure to finish new design assignments in a short time may take development resources away from efforts to optimise or re-engineer production processes. If approaching product design as an activity to be optimised independently there is a risk that target costing may not succeed to satisfactorily addressing overall performance, so in short decrease in unit production time may lead to unwanted pressure on design and its implementation stage.

Remedial Measures

As a remedial action organisation should retain strong control over the design teams headed by a good team leader. This person must have an exceptional knowledge of the design process, good interpersonal skills, and a commitment to staying within both time and cost budgets for a design project. If the time is too short even an organisation may

reject a project for the time being. Later, it can be tried out with new cost reduction methods or less expensive materials to achieve target cost and control overall production activities.

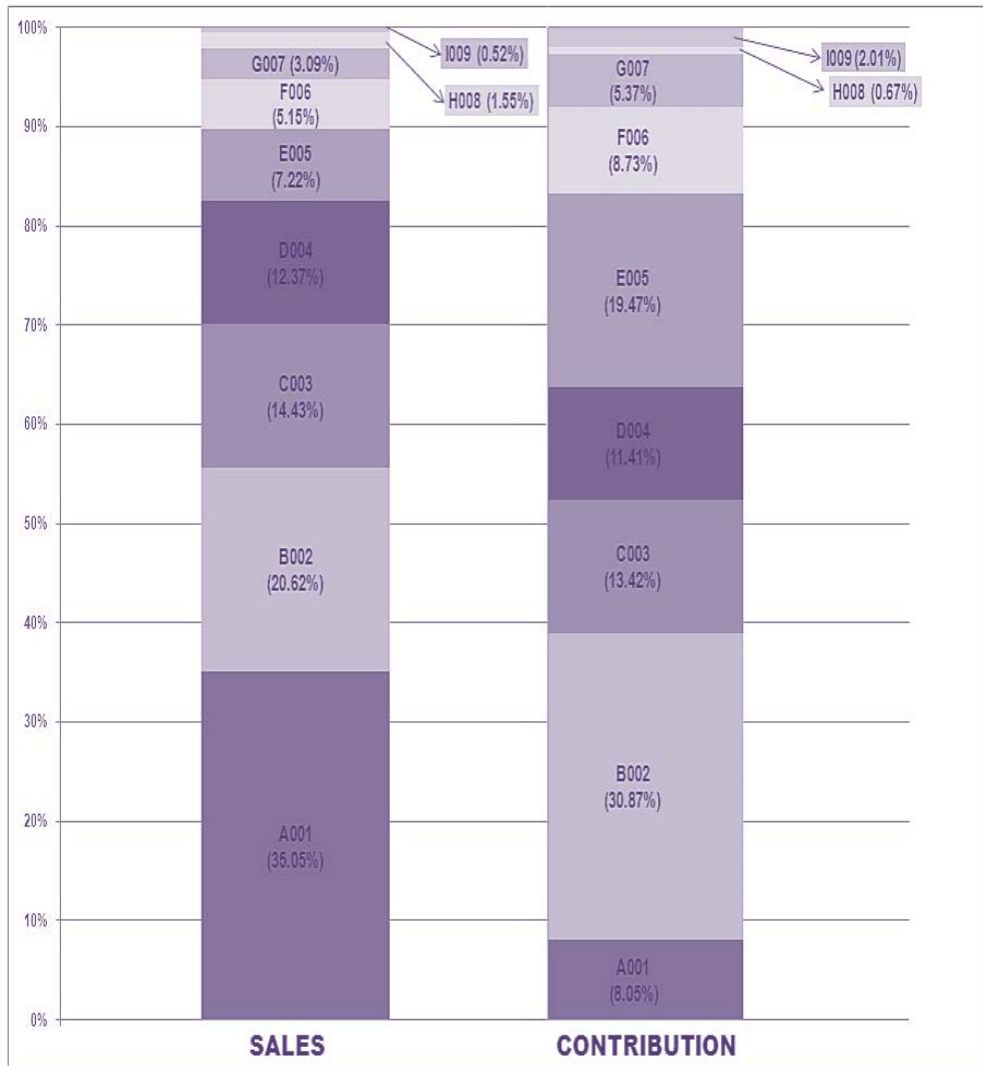
- (iii) Target costing is most useful in situations where *the majority of product costs are locked in during the product design phase*. This is the case for most manufactured products, but few services. In the services area, such as consulting, the bulk of all activities can be reconfigured for cost reduction during the “production” phase, which is when services are being provided directly to the customer. In the services environment, the “design team” is still present but is more commonly concerned with streamlining the activities conducted by the employees providing the service, which can continue to be enhanced at any time, not just when the initial services process is being laid out.

3. “Pareto Analysis”

Model	Sales (₹'000)	% of Total Sales	Cumulative Total	Model	Cont. (₹'000)	% of Total Cont.	Cumulative Total %
Pareto Analysis Sales				Pareto Analysis Contribution			
A001	5,100	35.05%	35.05%	B002	690	30.87%	30.87%
B002	3,000	20.62%	55.67%	E005	435	19.47%*	50.34%
C003	2,100	14.43%	70.10%	C003	300	13.42%	63.76%
D004	1,800	12.37%	82.47%	D004	255	11.41%	75.17%
E005	1,050	7.22%	89.69%	F006	195	8.73%*	83.90%
F006	750	5.15%	94.84%	A001	180	8.05%	91.95%
G007	450	3.09%	97.93%	G007	120	5.37%	97.32%
H008	225	1.55%	99.48%	I009	45	2.01%	99.33%
I009	75	0.52%	100.00%	H008	15	0.67%	100.00%
	14,550	100.00%			2,235	100.00%	

(*) Rounding - off difference adjusted.

Diagram Showing “Sales and Contribution”



Recommendations

Pareto Analysis is a rule that recommends focus on most important aspects of the decision making in order to simplify the process of decision making. The very purpose of this analysis is to direct attention and efforts of management to the product or area where best returns can be achieved by taking appropriate actions.

Pareto Analysis is based on the 80/20 rule which implies that 20% of the products account for 80% of the revenue. But this is not the fixed percentage rule; in general business sense, it means that a few of the products, goods or customers may make up most of the value for the firm.

In present case, five models namely A001, B002, C003, D004 account for 80% of total sales where as 80% of the company's contribution is derived from models B002, E005, C003, D004 and F006.

Models B002 and E005 together account for 50.34% of total contribution but having only 27.84% share in total sales. So, these two models are the key models and should be the top priority of management. Both C003 and D004 are among the models giving 80% of total contribution as well as 80% of total sales so; they can also be clubbed with B002 and E005 as key models. Management of the company should allocate maximum resources to these four models.

Model F006 features among the models giving 80% of total contribution with relatively lower share in total sales. Management should focus on its promotional activities.

Model A001 accounts for 35.05% of total sales with only 8.05% share in total contribution. Company should review its pricing structure to enhance its contribution.

Models G007, H008 and I009 have lower share in both total sales as well as contribution. Company can delegate the pricing decision of these models to the lower levels of management, thus freeing themselves to focus on the pricing decisions for key models.

4. (i) Total Contribution Statement

“Total Contribution- for remaining two stages”

Particulars	Maturity		Decline
	31 - 50	51 - 70	
Weeks	31 - 50	51 - 70	71 - 110
Number of units Produced and Sold	22,000	22,000	22,000
Selling Price per unit (₹)	450	450	300
Less: Unit Variable Cost (₹)	225	188	225
Unit Contribution (₹)	225	262	75
Total Contribution (₹)	49,50,000	57,64,000	16,50,000

(ii) Pricing Strategy for Product α^3

PGIL is following the skimming price strategy that's why it has planned to launch the product α^3 initially with high price tag.

A skimming strategy may be recommended when a firm has incurred large sums of money on research and development for a new product.

In the problem, PGIL has incurred a huge amount on research and development. Also, it is very difficult to start with a low price and then raise the price. Raising a low price may annoy potential customers.

Price of the product α^3 is decreasing gradually stage by stage. This is happening because PGIL wants to tap the mass market by lowering the price.

(iii) Possible Reasons for the changes in cost during the life cycle of the product ' α^3 '

Product life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle. Possible reasons for the changes in cost during the life cycle of the product are as follows:

PGIL is expecting reduction in unit cost of the product α^3 over the life of product as a consequence of economies of scale and learning / experience curves.

Learning effect may be the possible reason for reduction in per unit cost if the process is labour intensive. When a new product or process is started, performance of worker is not at its best and learning phenomenon takes place. As the experience is gained, the performance of worker improves, time taken per unit reduces and thus his productivity goes up. The amount of improvement or experience gained is reflected in a decrease in cost.

Till the stage of maturity, PGIL is in the expansion mode. The PGIL may be able to take advantages of quantity discount offered by suppliers or may negotiate the price with suppliers.

Product α^3 has the least variable cost ₹188 in last phase of maturity stage; this is because a product which is in the mature stage may require less marketing support than a product which is in the growth stage so, there is a saving of marketing cost per unit.

Again, the cost per unit of the product α^3 jumps to ₹225 in decline stage. As soon as the product reaches its decline stage, the need or demand for the product disappear and quantity discount may not be available. Even PGIL may have to incur heavy marketing expenses for stock clearance.

Workings

Cumulative Sales along with Sales Price and Variable Cost

Weeks	Demand per week	Total Sales	Cumulative Sales	Selling Price per unit (₹)	Variable Cost per unit (₹)
1 - 10	220	2,200	2,200	750	375
11 - 20	550	5,500	7,700	600	300
21 - 30	825	8,250	15,950	525	300
31 - 50	1,100	22,000	37,950	450	225
51 - 70	1,100	22,000	59,950	450	188
71 - 80	880	8,800	68,750	300	225

81 - 90	660	6,600	75,350	300	225
91 - 100	440	4,400	79,750	300	225
101 - 110	220	2,200	81,950	300	225

5. (i) **Statement Showing Product Life Cycle Characteristics and Strategies**

Products (1)	Phases (Stages) (2)	Characteristics (3)	Strategies (4)
P ₄	Introduction	(3)	(5), (11)
P ₃	Growth	(6)	(10), (8)
P ₂	Maturity	(1)	(4), (12)
P ₁	Decline	(9)	(2), (7)

(ii) **Importance of Product Life Cycle (PLC) Costing**

- As a Planning tool, it characterizes the marketing challenges in each stage and poses major alternative strategies, i.e. application of Kaizen.
- As a Control tool, the PLC concept allows the company to measure product performance against similar products launched in the past.
- As a Forecasting tool, it is very important because sales histories exhibit diverse patterns and the stages vary in duration.
- It leads to appropriate strategy formulation depending on the stages of the product life cycle.

(iii) **Benefits of Product Life Cycle Costing**

The benefits of product life cycle costing are summarized as follows:

- The product life cycle costing results in *earlier actions to generate revenue or to lower costs* than otherwise might be considered. There are a number of factors that need to be managed in order to maximize return on a product.
- Better decisions should follow from a *more accurate and realistic assessment of revenues and costs*, at least within a particular life cycle stage.
- Product life cycle thinking can promote *long-term rewarding* in contrast to short-term profitability rewarding.
- It provides an *overall framework for considering total incremental costs over the entire life span of a product*, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.
- It is an approach used to provide a *long-term picture of product line profitability*, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.

- It is also considered as a way to enhance the *control of manufacturing costs*. The thrust of product life cycle costing is on the distribution of costs among categories changes over the life of the product, as does the potential profitability of a product. Hence it is important to track and measure costs during each stage of a product's life cycle.
- Product life cycle costing *traces research and design and development costs* etc., incurred to individual products over their entire life cycles, so that the total magnitude of these costs for each individual product can be reported and compared with product revenues generated in later periods.

6. (i) Product Wise Profitability as per Original Allocation Methodology

(Figures in ₹ per kilogram of fertilizer produced)

Particulars	Grade A	Grade B	Total
Selling Price	280	400	680
Direct Material (Refer Table 1)	114	186	300
Direct Labour (Refer Table 1)	76	124	200
Overheads (allocated equally)	75	75	150
Total Expenses	265	385	650
Profit	15	15	30
Profitability	5.36%	3.75%	×

Table 1 Allocation of Direct Materials and Labour as per Cost Centre and Product

Particulars	CC1			CC2			CC3			Total for the company		
	A	B	CC Total	A	B	CC Total	A	B	CC Total	Gr. A	Gr. B	Grand Total
Direct Material	27	63	90	60	60	120	27	63	90	114	186	300
Direct Labour	18	42	60	40	40	80	18	42	60	76	124	200



Product Wise Profitability (activity based costing using environmental management accounting) requires the following **steps**:

1. Overhead expenses of ₹ 150 per kilogram of fertilizer produced be first bifurcated into incinerator costs and other overhead costs.
2. Incinerator costs of ₹ 90 per kilogram of fertilizer needs to be allocated first to the cost centres. This is done based on the waste generated at each cost centre. The individual cost allocated to each cost centre is again allocated to products based on the waste generated at each cost centre by each product. Refer part a of table 2 for detailed calculations.
3. As mentioned in the problem, other overhead costs are allocated to each product at each cost centre level equally. Refer part b of table 2 for detailed calculations.
4. The above allocations to each product at a cost centre level is then summed up to get the product wise overhead cost allocation. Refer part c of table 2 for detailed calculations.

Accordingly, the **Revised Product Profitability** would be as follows:

(Figures in ₹ per kilogram of fertilizer produced)

Particulars	Grade A	Grade B	Total
Selling Price	280	400	680
Less: Direct Material (refer table 1)	114	186	300
Less: Direct Labour (refer table 1)	76	124	200
Less: Overheads (refer table 2)	66	84	150
Profit	24	6	30
Profitability	8.57%	1.50%	×

Table 2 Allocation of Overhead Expenses to each Cost Centre and Product

(Figures in ₹ per kilogram of fertilizer produced)

Product Waste Produced (in tonnes per annum)	CC1	CC2	CC3	Total
Grade A	2	3	1	6
Grade B	2	2	5	9
Total Waste (in tonnes)	4	5	6	15
Incinerator Cost Allocated to Cost Centres (based on waste generated)	24	30	36	90
Other Overhead Expenses	20	20	20	60
Total Cost Centre Wise Overhead Cost	44	50	56	150

Part A: Allocation of Incinerator Cost from Cost Centre to each product <i>(based on waste produced at each cost centre by each product)</i>				
Product	CC1	CC2	CC3	Total
Grade A	12	18	6	36
Grade B	12	12	30	54
Total Incinerator Cost	24	30	36	90
Part B: Allocation of Other Overhead Cost from Cost Centre to each product				
Product	CC1	CC2	CC3	Total
Grade A	10	10	10	30
Grade B	10	10	10	30
Total Other Overhead Cost	20	20	20	60
Part C: Total Overhead Cost (Cost Centre and Product Wise i.e. part a + b)				
Product	CC1	CC2	CC3	Total
Grade A	22	28	16	66
Grade B	22	22	40	84
Total Overhead Cost	44	50	56	150

Summarizing Product Profitability as per both methods:

Product	(Profit in ₹ per kg of fertilizer produced)		Profit %	
	Original Method	ABC (as per EMA) Method	Original Method	ABC (as per EMA) Method
Grade A	15	24	5.36%	8.57%
Grade B	15	6	3.75%	1.50%

- (ii) As summarized above, originally the profit generated from Grade A and Grade B products, was ₹15 per kilogram. Grade A was the more profitable product giving return of 5.36% compared to Grade B's return of 3.75%. This has been calculated by allocating overheads equally to Grade A and B.

During the year, 15 tons of waste is produced during the manufacturing process. Grade B fertilizer produces more waste that accounts for 60% of the waste. Therefore, Grade B should bear higher amount of the incinerator cost compared to Grade A. Allocation based on this premise, dramatically changes the profitability of the products. As calculated above, Grade A fertilizer, due to lower incinerator cost allocation, generates a profit of ₹24 per kilogram of fertilizer. Grade B's profits accordingly are lower, since the product generates more waste and has to bear a larger share of clean-up expenses. Profitability of Grade A increases to 8.57% while Grade B falls dramatically to 1.50%.

- (iii) The company can draw a number of conclusions from this analysis of overhead costs as per environmental management accounting. This analysis has helped the company reach the conclusion that Grade B fertilizer produces more waste. The company could adopt either of the following approaches:
- (a) To maintain the same level of profitability, the company can increase the price of Grade B by another ₹9 per kilogram. This is a 2.25% increase in the sale price of Grade B fertilizer. Depending on the market for this grade of fertilizer, the company has to decide whether to increase the price of the product. While a price increase may be possible if the company has a strong market hold, it might be difficult if competition in the market is high. or
 - (b) The other approach, a more sustainable approach that is the aim of environmental management accounting, would be to reduce the waste produced in the manufacturing process. This analysis, has quantified the waste generated in the process. Better manufacturing techniques, could save the company incinerator costs, that would yield better profits for the company.



COST MANAGEMENT FOR SPECIFIC SECTOR



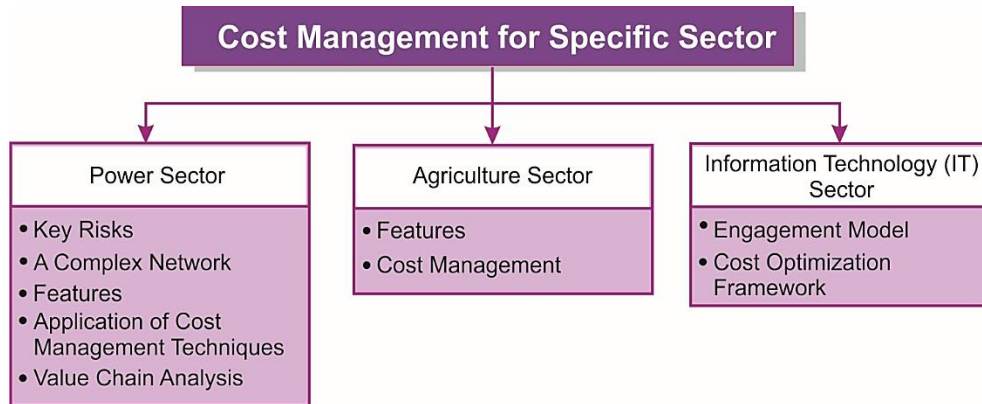
LEARNING OUTCOMES

After studying this chapter, you will be able to:

- **Apply** Cost Management Techniques



CHAPTER OVERVIEW



POWER SECTOR

Thermal Power Plants are one of the main sources of electricity in India. The variation in the thermal power stations is due to the different fuel sources (coal, natural gas, naphtha, etc.). Apart from thermal power plants, there are other types of energy resources being used to generate electricity. The various types of energy sources include hydro- electricity, solar power, wind power, nuclear power, etc.

Key Risks in the Sector¹

Highly Capital Intensive

Power sector is a *highly capital intensive* business with long gestation periods before commencement of revenue streams (construction periods of 7-8 years) and an even longer operating period (over 25 years). Since most of the projects have such a long time frame, there are some inherent risks in both the internal and external environment.

Coal Supply Position

More than 50 percent of India's generation capacity is coal based. According to the Integrated Energy Policy, by FY31-32, India requires 2,040 million tonnes of coal for power generation, more than 5 times its current consumption levels. The shortage of coal is so acute that most of the power generation companies are looking at imported coal as a viable alternative to domestic coal.

Electricity Distribution – A Complex Network²

Electricity is generated at power plants and moves through a complex system, sometimes called the *grid*, of electricity substations, transformers, and power lines that connect electricity producers and consumers. Most local grids are interconnected for reliability and commercial purposes, forming larger, more dependable networks that enhance the coordination and planning of electricity supply.



Features of Power Sector

- Limited number of suppliers of electricity.
- Tariff determination is based upon the rationality to determine the cost incurred at various points of operation.
- Stakeholders are existing and future consumers, industries, government, regulators, and investors.
- Continuous growing demand of electricity.
- Flexible Cost allocation.
- Distribution loss and inefficiency gaps between generation and consumption of electricity.
- In-disciplined consumer.
- Continuous network between generators, transmitters, distributors, and consumers.
- Mostly public sector undertakings closely regulated by government.
- Energy subsidies having direct impact on national treasury affecting long term growth potential of the economy.

Application of Cost Management Techniques in Power Sector

- For determining prices and regulating tariffs.
- Developing a flexible cost allocation.
- Distribution loss and inefficiency gap analysis.
- Multi-dimensional costing calculations.
- Powerful analysis and reporting.

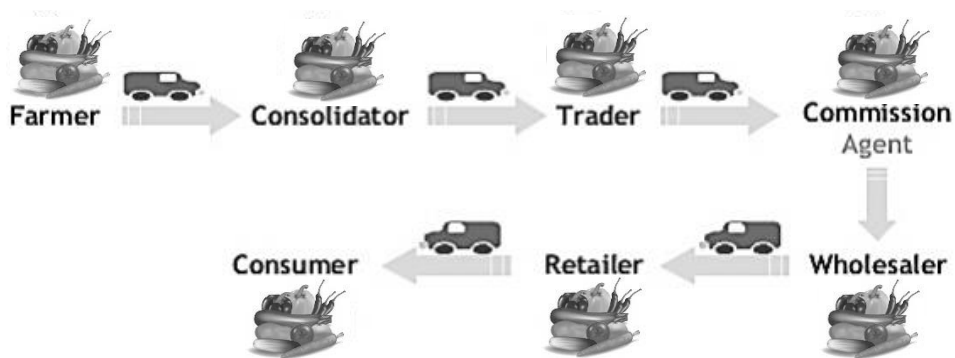
Value Chain Analysis³

This involves ensuring value creation in all the activities both inbound and outbound activities undertaken by the power company starting from electricity generation to the point of supply or distribution of the electricity supply.



References: 1- Annual Report, Reliance Power Ltd.; 2- <https://www.eia.gov>; 3- Enterprise IoT: Strategies and Best Practices for Connected Products and Services by Dirk Slama, Frank Puhmann, Jim Morrish, Rishi M Bhatnagar, p32

AGRICULTURE SECTOR



Features

- Challenges associated with structure of the industry which is fragmented and unorganized
- Lack of understanding of costs
- Understanding the potential of working collaboratively
- Use of target costing techniques for price determination
- Imbalance of power across the supply chain

Fragmented Structure of the Industry

The structure of the agriculture sector is seen to be unorganized and fragmented in nature and thus lack of effective regulation in the given sector is also seen as one of the reasons why farmers seem to be exploited and have been operating at very low margins.

Lack of understanding of costs and prices by the farmers

One of the key reasons seen for the lack of appropriate cost management in the given sector is with regards to the lack of prioritization of the cost management among farmers because of lack of knowledge with regards to the same.

Understanding the potential to work collaboratively

The farmers need to be open to innovation in cost management and contracting techniques. Though there is scope for cost reduction in order to bring about improvement in the profit margins for the farmers, it is seen that generally the profits tend to get transferred to the customers and the only point of negotiation is in the contract pricing with the retailers which the farmers fail to reach.

Target cost Management

The target costing technique involves determining the cost by subtracting the required margin from the anticipated price for the agricultural produce. However, the anticipated price for the agricultural products fluctuates making the process of cost management using the target cost management system ineffective in the case of the agricultural sector.

Imbalance of power distribution

With the fragmentation and the unorganized nature of the farmers operating in the agricultural sector, the power of bargaining seems to lie in the hands of the wholesalers purchasing the produce from the farmers resulting in overall low margins for farmers in comparisons to the margins earned by the wholesalers and the retailers operating in the said sector.

Cost Management

Cost Management focuses upon all the activities internal and external to the value chain process in order to help in cost reduction and cost control. In relation to the agricultural sector, the Activity Based Costing technique is being increasingly accepted for the purpose of cost management.

Large scale enterprises engaged in the agriculture sector that are engaged in the investment of high scale capital expenditure require efficient utilization of technology as well as the efficient use of production technology that are available at their disposal.

Thus, the Activity Based Costing as the name suggests provides a better manner in which the indirect costs associated with the processes carried out in the agricultural sector can be carried out in an efficient manner.

It is a step up from the target cost management technique where the fluctuation in the anticipated price which forms part of the formula might not result in appropriate determination of the target costs.

Therefore, ABC costing can help in allocation of the costs in relation to the various activities associated with the production based upon the cost drivers identified in relation to each production activity.

Benefits of using ABC for cost management in the agricultural sector

- Adjustable costing technique
- Faster and more accurate
- Enables carrying out a more detailed cost analysis

Minimum Support Price (MSP)

In India, Minimum Support Price (MSP) was introduced by the Government of India to protect farmers against sharp dip of agricultural prices, which was usually observed during the harvest seasons. The harvest seasons are associated with huge supply, which overshadows the demand, and hence, in most cases the commodity prices hit the bottom. This forces the farmers, in necessity of money for repayment of debts, in selling their produce at losses or very little profits. Thus, the government fixes the MSP, as a part of government food grain procurement. Selling at MSP ensures profit margins for farmers and avoids distress selling situations.

Source: <http://farmer.gov.in/mspdet.aspx>



INFORMATION TECHNOLOGY (IT) SECTOR

There are a number of challenges associated with the management of the costs associated with the Information Technology expenditures incurred by the Multi-National corporations. Thus, the complexity of the operating structure and the difficulty seen in the implementation of the cost allocation models, it is seen that in order to manage the IT costs, most organizations tend to develop centralized IT departments acting as cost centers for the purpose of managing the IT budgets as well as allocation of costs associated with along with the charging back of expenses that are incurred by the business units.

IT Organization's Engagement Model

The question that needs to be addressed under the same is that whether the IT organization should be organized as a cost center to the organization or whether it should be seen as a strategic partner to the business. With more and more organizations whether large or small in nature, opting for third party allocation or opting for cloud computing services it can be seen that the internal IT departments are fighting hard for remaining relevant for the organization. In order to stay relevant, what the It department needs is a better visibility towards the IT needs of the organization. In order to do the same, organizations operating in the given sector can adopt what is referred as to the 4D framework.

4D IT Cost Optimization Framework

Defining Organization Vision

Any amount of spending carried out in relation to the Information Technology requirements of the organization needs to be aligned to the organizational vision and long term objectives. Business owners should have a sense of ownership and thereby control the IT costs in an effective manner. The perspectives of the key stakeholders i.e. CEO, CFO and directors must be taken into consideration when deciding upon the IT consumption within the organization.

The additional visibility through the model needs to determine the appropriate method of cost allocation in relation to the IT cost burden. Thus, the allocation model that is chosen needs to be both flexible and at the same time avoid being too complex in nature. The organization can either opt for a simple method of dividing the entire IT cost by the number of hours consumed by each department or a more complex but accurate method of ABC costing could be used for allocation of the costs based upon the associated cost drivers associated with each set of activities.

Documentation of the current state

The next step involves documentation of the current state of the IT department implemented within the organization in order to identify gaps and potential weaknesses identified in relation to the current state for the purpose of identification of the appropriate pain points as well as identification of areas for potential automation.

Delineation of target business architecture

Once the current state of the IT architecture has been documented, the next step is developing a target business architecture for the purpose of addressing the gaps and limitations identified and laying down the foundation with regards to the formation of the crux of the IT cost management framework.

Decision: Build v/s Buy

The last step understands whether the framework built is bought or custom built internally. The answer to the question involves a great amount of brainstorming and research taking into consideration the view point of all the strategic stakeholders involved.

**SUMMARY**

- Thermal Power is main source of electricity in India. Fuel sources include – coal, natural gas, neptha, etc. The various types of energy sources include hydro- electricity, solar power, wind power, nuclear power, etc.
- Key Risks in Power Sector – Highly Capital Intensive, Deficiency of Coal Supply.
- Electricity is generated at power plants and moves through a complex system, sometimes called the grid, of electricity substations, transformers, and power lines that connect electricity producers and consumers.
- Features of Power Sector – Limited number of Suppliers, Complexity in determination of tariff, stakeholders include consumers, industries, government, regulators, and investors, Continuous growing demand of electricity, Flexible Cost allocation, Distribution loss and inefficiency gaps between generation and consumption of electricity, In-disciplined consumer, Continuous network between generators, transmitters, distributors, and consumers, public sector undertakings, impact on national treasury through energy subsidies.
- Application of Cost Management Techniques in Power Sector- Determining prices and regulating tariffs, Developing a flexible cost allocation, Distribution loss and inefficiency gap analysis, Multi-dimensional costing calculations, Powerful analysis and reporting.
- Value Chain Analysis - Value creation in all the activities both inbound and outbound activities undertaken by the power company starting from electricity generation to the point of supply or distribution of the electricity supply.
- Agricultural Sector Features – Fragmented and unorganized industry, lack of understanding of costs, potential of working collaboratively, target costing techniques for price determination, imbalance of power across the supply chain.
- Cost Management in Agricultural Sector – Activity Based Costing technique is being increasingly accepted for the purpose of cost management as it is adjustable costing technique, faster and more accurate, and enables a more detailed cost analysis.
- IT Sector Features – Complex operating structure, difficult implementation of cost allocation methods.



DECISION MAKING

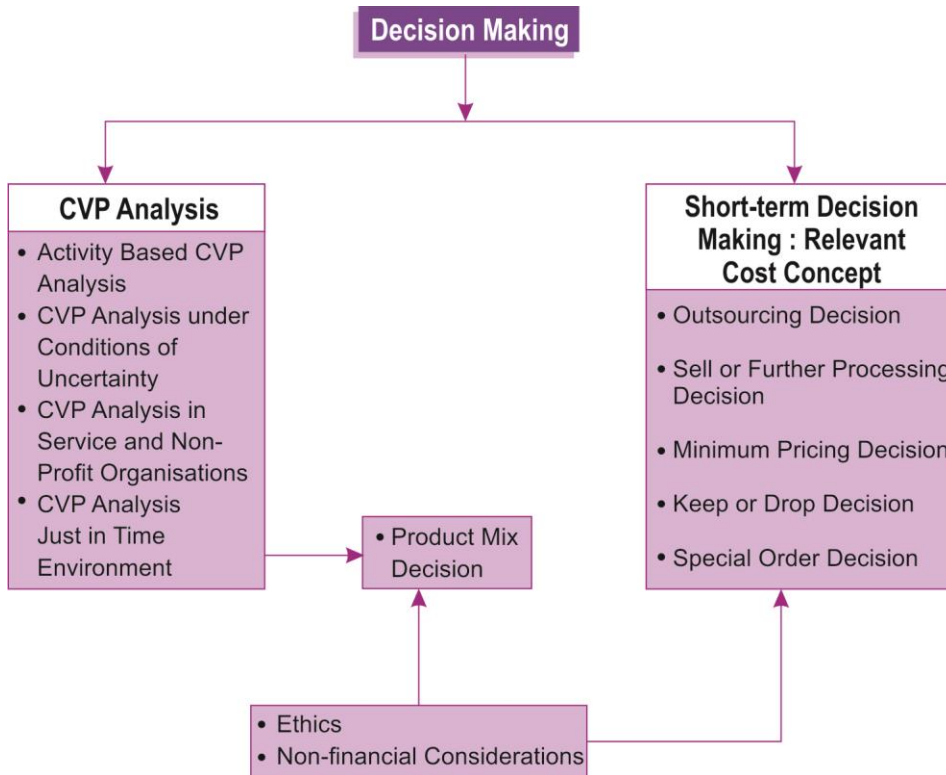


LEARNING OUTCOMES

After studying this chapter, you will be able to:

- ❑ **Analyse** short-term decisions
- ❑ **Analyse** product mix decisions, including circumstances where linear programming methods are needed to identify 'optimal' solutions
- ❑ **Analyse** information to assess risk and its impact on short-term decisions
- ❑ **Discuss** the nature of risk and uncertainty and the attitudes to risk by decision makers
- ❑ **Evaluate** information to support project appraisal
- ❑ **Analyse** information for use in long-term decision making (including consideration of tax, inflation and other factors)
- ❑ **Compare and Contrast** alternative approaches proposed to address business challenges or opportunities for a given entity

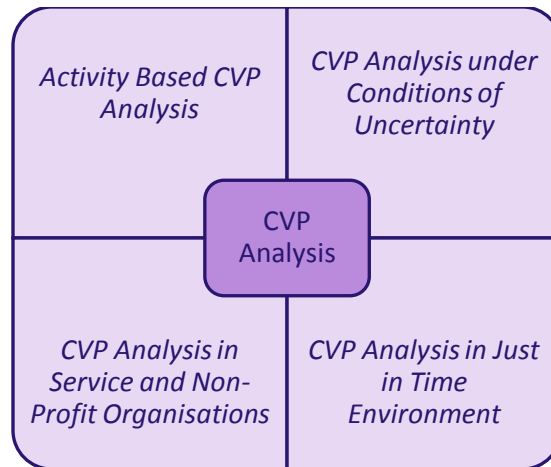
CHAPTER OVERVIEW



CVP ANALYSIS¹

CVP analysis involves analysing the interrelationships among revenues, costs, levels of activity, and profits. CVP analysis is useful for numerous decisions related to production, pricing, marketing, cost structure, and many more. Although CVP analysis is most useful for planning, it can also be used to assist with controlling decisions and evaluating decisions.

Consider a decision about choosing *additional features of an existing product* i.e. product modification. Different choices can affect selling prices, variable cost per unit, fixed costs, units sold, and operating income. CVP analysis helps managers make product decisions by estimating the *expected profitability* of these choices.



Activity Based CVP Analysis

Conventional CVP analysis assumes volume based measures. An alternative approach is activity based costing. In an activity-based costing system, costs are segregated into unit and *non-unit-based* categories. Activity-based costing acknowledges that some costs vary with units produced and some costs do not. However, while activity-based costing admits that non-unit-based costs are fixed with respect to production volume changes, it also argues that many non-unit-based costs vary with respect to other cost drivers. In contrast, the volume based approach combines the cost of these activities and treat them as fixed costs since they do not vary with output volume. Activity based costing provides a more accurate determination of costs because it separately identifies and traces non-unit based costs to products rather than combining them in a pool of fixed costs as volume based approach does.

The Break-even can then be expressed as follows:

$$\text{Break-even units} = \frac{[\text{Fixed costs} + (\text{Setup cost} \times \text{Number of Setups}) + (\text{Engineering Cost} \times \text{Number of Engineering Hours})]}{(\text{Price} - \text{Unit Variable Cost})}$$

A comparison of the ABC break-even point with the conventional break-even point reveals two important differences.

First, the fixed costs differ. Some costs previously identified as being fixed may actually vary with non-unit cost drivers, in this case setups and engineering hours.

Second, the numerator of the ABC break-even equation has two non-unit-variable cost terms: one for batch-related activities and one for product-sustaining activities.

“The use of activity-based costing does not mean that CVP analysis is less valuable. In fact, it becomes more valuable, since it delivers more precise understandings concerning cost behaviour. These understandings produce better decisions. CVP analysis within an activity-based framework, however, must be improved”.

Illustration

Catalyst Ltd. Makes a single product with the following details:

Description	Current Situation	Proposed Change
Selling Price (₹/unit)	10	
Direct Costs (₹/unit)	5	
Present number of setups per production period, (before each production run, setup is done)	42	
Cost per set up (₹)	450	Decrease by ₹90
Production units per run	960	1,008
Engineering hours for production period	500	422
Cost per engineering hour (₹)	10	

The company has begun Activity Based Costing of fixed costs and has presently identified two cost drivers, viz. production runs and engineering hours. Of the total fixed costs presently at ₹96,000, after the above, ₹72,100 remains to be analyzed. There are changes as proposed above for the next production period for the same volume of output.

Required

- COMPUTE units and production runs Catalyst Ltd. should produce in the changed scenario for break-even.
- ADVISE whether Catalyst Ltd. should continue to break up the remaining fixed costs into activity based costs.

Solution**Workings****Statement Showing 'Non-unit Level Overhead Costs'**

Particulars	Current Situation	Proposed Situation
No. of Production Runs/ Setups	42	40 $\left(\frac{960 \text{ runs} \times 42 \text{ setup}}{1,008 \text{ units}} \right)$
Cost per Setup	₹450	₹360
Production Units <i>per run</i>	960 units	1,008 units
Production Units	40,320 (960 units × 42)	40,320
Engineering Hrs.	500	422
Engineering Cost <i>per hour</i>	₹10	₹10

Requirement of Question**(i) Break Even Point (Changed Scenario)**

Break Even Point

$$= \frac{\text{Fixed Cost} + (\text{Setup Cost} \times \text{No. of Setups}) + (\text{Engineering Costs} \times \text{No. of Engineering Hrs.})}{(\text{Price} - \text{Unit Variable Cost})}$$

$$= \frac{\text{₹ } 72,100 + (\text{₹ } 360 \times 40 \text{ Setups}) + (\text{₹ } 10 \times 422 \text{ hrs.})}{(\text{₹ } 10 - \text{₹ } 5)}$$

$$= 18,144 \text{ units}$$

Break Even Point (No of Production Runs)

$$= \frac{\text{Break Even (units)}}{\text{Production (units per run)}}$$

$$= \frac{18,144 \text{ units}}{1,008 \text{ units}}$$

$$= 18 \text{ Runs}$$

- (ii) A company should adopt Activity Based Costing (ABC) system for *accurate product costing*, as traditional volume based costing system does not take into account the *Non-unit Level Overhead Costs* such as Setup Cost, Inspection Cost, and Material Handling Cost etc. Cost Analysis under ABC system showed that while these costs are largely fixed with respect to sales volume, but they are not fixed to other appropriate cost drivers. If break up the remaining ₹ 72,100 fixed costs consist of only a small portion of these costs, ABC need not be applied.

However, it may also be noted that the primary study has resulted in cost savings. If the savings in cost are expected to exceed the cost of study and implementing ABC, it may be justified. Further it is pertinent to mention that ABC offers no increase in product-costing accuracy for single-product setting.

CVP Analysis - Conditions of Uncertainty

Cost-Volume-Profit analysis suffers from a limitation that it does not consider adjustments for *risk* and *uncertainty*. A possible approach by which uncertainty can be incorporated into the analysis is to apply *normal distribution theory*. If the manager is comparing this product with other products then this approach will enable him or her to assess the risk involved for each product, as well as to compare the relative break-even points and expected profits. The analysis can be changed to include fixed cost, variable cost and selling price as *uncertain variables*. The effect of treating these variables as uncertain will lead to an increase in the standard deviation because the variability of the variable cost, fixed cost and selling price will add to the variability of profits. Probability distributions play important role in providing decision-making information. It provides information that helps the decision maker better understand the risks and uncertainties associated with the problem. Ultimately, this information may assist the decision maker in reaching a good decision.

Example

The selling price of a product for the next accounting period is ₹110, and the variable cost is estimated to be ₹70 per unit. The budgeted fixed costs for the period are ₹1,63,500. Estimated sales for the period are 5,000 units, and it is assumed that the probability distribution for the estimated sales quantity is normal with a standard deviation of 125 units. The selling price, variable cost and total fixed cost are assumed to be certain. What is the probability of profits being greater than ₹40,000?

The calculations are as follows:

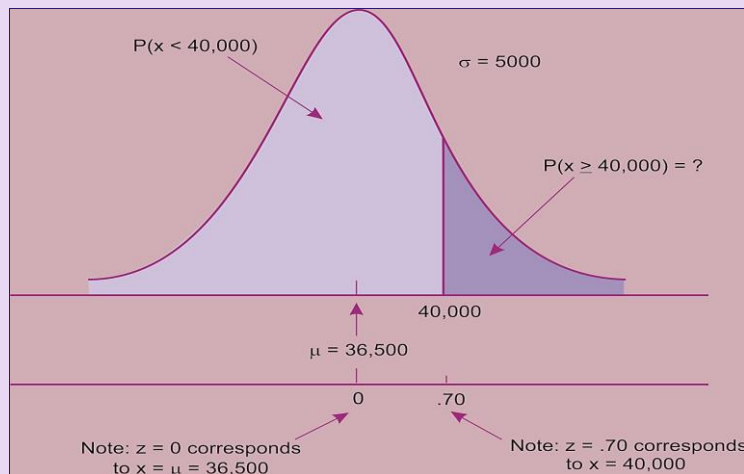
$$\begin{aligned} \text{Expected Profit} &= \text{Expected Sales Volume (5,000 units)} \times \text{Contribution per unit (₹40)} - \\ &\quad \text{Fixed Costs (₹163,500)} \\ &= ₹36,500 \\ \text{Standard Deviation} &= \text{Standard Deviation of Sales Volume (125 units)} \times \text{Contribution per} \\ &\quad \text{unit ₹40} \\ &= ₹5,000 \end{aligned}$$

Probability for profit (₹40,000):

$$\begin{aligned} Z &= \frac{x - \mu}{\sigma} \\ Z &= \frac{₹40,000 - ₹36,500}{₹5,000} \\ Z &= +0.70 \end{aligned}$$

Probability ($Z = +0.70$) = 0.7580

Refer now following Figure



We see that a value of 40,000 corresponds to a value of $Z = 0.70$ on the standard normal distribution. Using the standard normal probability table, we see that the area under the standard normal curve to the left of $Z = 0.70$ is 0.7580. Thus, $1.000 - 0.7580 = 0.2420$ is the probability that profit will exceed 40,000.

CVP Analysis in Service and Non-Profit Organisations

CVP analysis can also be applied to decisions by service and non-profit organisations. To apply CVP analysis in service and non-profit organisations, we need to *focus on measuring their output*, which is different from tangible units sold by manufacturing and merchandising companies.

Illustration

Expert Roadways Services Pvt. Ltd. is planning to run a fleet of 15 buses in Birpur City on a fixed route. Company has estimated a total of 2,51,85,000 passenger kilometers per annum. It is estimated buses to have 100% load factor. Buses are purchased at a price of ₹44,00,000 per unit whose scrape value at the end of 5 years life is ₹5,50,000. Seating capacity of a bus excluding a Driver's seat is 42. Each bus can give a mileage of 5 kmpl. Average cost of fuel is ₹66 per liter. Cost of Lubricants & Sundries per 1,000 km would be ₹3,300. Company will pay ₹27,500 per month to Driver and two attendants for each bus.

Other annual charges per bus: Insurance ₹55,000, Garage Charges ₹33,000, Repairs & Maintenance ₹55,000. Route Permit Charges upto 20,000 km is ₹5,500 and ₹2,200 for every additional 5,000 km or part thereof.

Required

- CALCULATE a suggested fare per passenger/km taking into account markup on cost @20% to cover general overheads and sufficient profit.*
- The Transport Sector of Birpur is highly regulated. The Government has fixed the fare @ ₹1.35 for next 2 years. COMMENT on the two year's profitability taking into consideration the inflation rate of 8%.*

Note: Route permit charges is not subject to Inflation.

Solution

- Statement Suggesting "Fare per passenger – km (Each Bus)"**

Particulars	Cost per annum (₹)
Fixed Expenses:	
Insurance	55,000.00
Garage Charges	33,000.00
Depreciation	7,70,000.00
Running Expenses:	
Repair and Maintenance	55,000.00
Cost of Lubricants and Sundries	1,38,517.50
Fuel Cost	5,54,070.00

Salary of Driver and Two Attendants	3,30,000.00
Route Permit Charges	16,500.00
Total Cost <i>per annum</i>	19,52,087.50
Add: Markup @ 20% of Total Cost or 16.67% of Total Revenue	3,90,417.50
Total Revenue	23,42,505.00

Rate *per passenger- km* equals to ₹1.395

Workings

Total Passenger Kms	=	2,51,85,000
Total Buses	=	15
Passenger Kms <i>per bus</i>	=	16,79,000 (2,51,85,000 Kms / 15)
Total Passenger Capacity <i>per bus</i>	=	42 – 2
	=	40
Annual Distance Covered <i>by a bus</i>	=	41,975 Kms. (16,79,000Kms/ 40)

(ii) Regulated Fare *per passenger km* is ₹1.35

Profitability Statement for Each Bus

Particulars	Year 1 (₹)	Year 2 (₹)
Fixed Expenses:		
Insurance	59,400.00	64,152.00
Garage Charges	35,640.00	38,491.20
Depreciation	7,70,000.00	7,70,000.00
Running Expenses:		
Repair and Maintenance	59,400.00	64,152.00
Cost of Lubricants and Sundries	1,49,598.90	1,61,566.81
Fuel Cost	5,98,395.60	6,46,267.25
Salary of Driver and Two Attendants	3,56,400.00	3,84,912.00
Route Permit Charges	16,500.00	16,500.00
Total Cost ...[A]	20,45,334.50	21,46,041.26
Total Revenue (Regulated) ...[B]	22,66,650.00	22,66,650.00
Profit ...[B] – [A]	2,21,315.50	1,20,608.74
Profit to Total Revenue	9.76%	5.32%

The gross margin is showing a downward trend because the cost components have taken into the effect of inflation hence increasing year by year but the total revenue has remained stagnant due to Government regulations which resulted in reduction in gross margin per bus.

The company's gross margin to total revenue ratio has come out to be 9.76% and 5.32% in first and second year respectively but initially the company's desired gross margin to total revenue ratio is 16.67% to cover general overheads and sufficient profit. Though the amount of general overheads is not given but we can safely assume that they may also be subject to inflation i.e. increase year by year then in such case the company needs to maintain or increase its gross margin per bus to maintain its net profit after general overheads which is not possible in a regulated environment. The information about regulated fare in the given case is regarding the first two years only but if this regulated fare scenario persists for further years then the project may not be viable for the company.

CVP Analysis in Just in Time Environment

In a firm that has implemented *Just in Time*, the variable cost per unit sold is reduced, and fixed costs are increased. Direct labor is considered as fixed instead of variable. On the other hand, direct material, varies with production volume (unit-based variable cost) due to emphasis on *total quality* and *long-term purchasing*. Waste, scrap, and quantity discounts are removed. Other unit-based variable costs, such as power and sales commissions, also exist. Further, the *batch-level* variable is absent as in *Just in Time*, the batch is equal to one unit. Therefore, the cost equation for *Just in Time* can be expressed as follows:

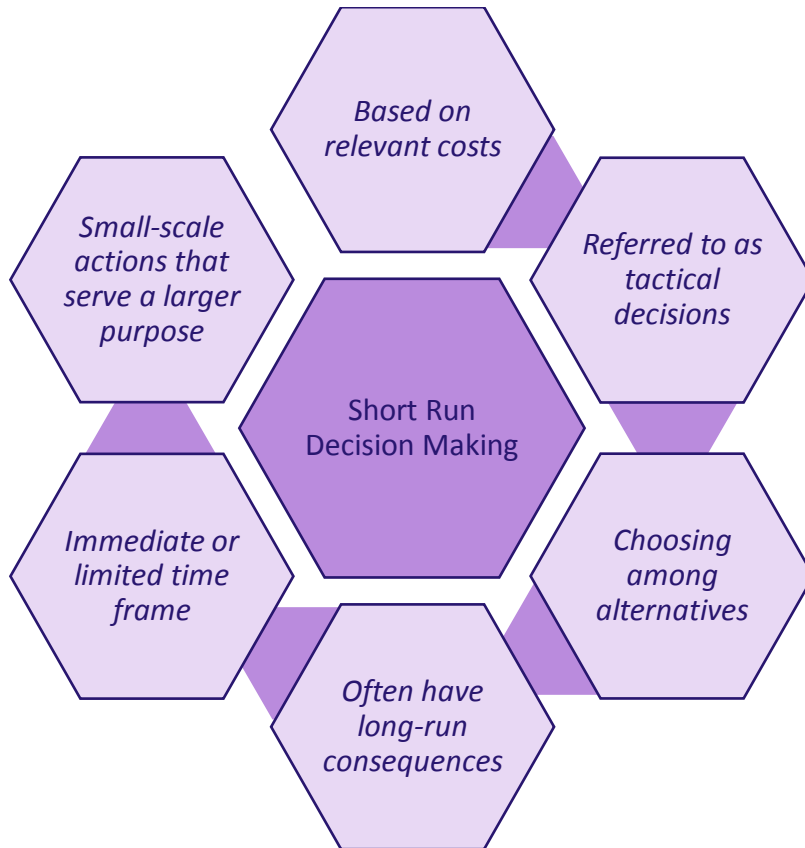
$$\text{Total Cost} = \text{Fixed Cost} + (\text{Unit variable Cost} \times \text{Number of Units}) + (\text{Engineering Cost} \times \text{Number of Engineering hours})$$

“Managers often use CVP analysis to guide other decisions, many of them are of strategic nature due to tremendous potential of increase in the profitability and organisational effectiveness”

(1. Source/ References: Accounting: Concepts and Applications By W. Albrecht, James Stice, Earl Stice, Monte Swain; Cost Management: A Strategic Emphasis By Blocher; Managerial Accounting, Hansen Mowen; Cost Accounting: A Managerial Emphasis, 13/e By Charles T. Horngren; Cost Management: Accounting and Control By Don Hansen, Maryanne Mowen, Liming Guan; Essentials of Modern Business Statistics with Microsoft Excel By David R. Anderson, Dennis J. Sweeney, Thomas A. Williams)



SHORT RUN DECISION MAKING



Short-run decision making involves the act of choosing one course of action among various feasible alternatives available. Short-term decisions sometimes are referred to as tactical, or relevant, decisions because they involve choosing between alternatives with an immediate or limited time frame. Strategic decisions, on the other hand, usually are long term in nature because they involve choosing between different strategies that attempt to provide a *competitive advantage* over a long time frame. Short run decisions involve evaluation of the costs and benefits of short term actions, such as whether to make a product or outsource, whether to accept a special order, whether to keep or drop an unprofitable segment, and whether to sell a product as is or process it further. If resources are limited, managers may also have to decide on the most appropriate product mix. While such decisions tend to be *short run* in nature, it should be emphasized that they often have long-run consequences. Consider a second example, Suppose that a company is thinking about producing a component instead of buying it from suppliers. The immediate objective may be to lower the cost of making the main product. Yet this decision may be a small part of the overall strategy of establishing a cost leadership position for the firm. Therefore, short-run decisions often are *small-scale actions that serve a larger purpose*².

The tactical decision making approach just described emphasized the importance of identifying and using **relevant costs**. But how do we identify and define the costs that affect the decision?

For a cost to be relevant to a decision it must be

- 1) A future cost, i.e. related to the future.
- 2) A differential Cost, i.e. its level must be different for each of the alternatives under consideration.

Accordingly, only future costs can be relevant to decisions. However, to be relevant, a *cost must not only be a future cost but must also differ from one alternative to another*. If a future cost is the same for more than one alternative, it has no effect on the decision. Such a cost is irrelevant cost. The ability to identify relevant and irrelevant costs is a vital decision making skill.

Non-Financial Considerations

With increase in competition, dynamic market changes and changing needs of customers, non-financial information have gained relevance in the decision-making process. Information to which monetary value can be attached is in the nature of financial information. Information of an organization like number of employees, employee morale, customer satisfaction that cannot be expressed in monetary terms is termed non-financial in nature. *Non-financial information is **long term focused** and ensures profitability and sustainability in long term for an organization thereby evaluating the internal performance of the company.* Non-Financial information which a company should focus that would turn out to be advantageous while making decisions for a company are:

- Quality
- Employee Satisfaction
- Customer Satisfaction
- Corporate Social Responsibility
- Environmental Factors
- Intellectual Property
- Intangible Assets
- Competitor's Movements
- Brand Name

Decisions made in a business rest on the *balance between the perceived effects of financial and non-financial information*. Following are Limitations of Non-Financial Information-

- Time and Cost of the company involved.
- Subjective measurement – No proper of common denominator to measure performance.

- Improper measures will lead the companies to draw attention on wrong objectives.
- Lack of Statistical Reliability – Possible chances of error.
- Management Disintegration when excess of measures and indications used by the company.

Ethics

Ethics are moral principles that guide the conduct of individuals. By their behaviour and attitude, managers set the company culture. Guideline for Ethical Conduct³:

- Identify an ethical decision by using personal ethical standards of honesty and fairness.
- Identify the consequences of the decision and its effect on others.
- Consider obligations and responsibilities to those that will be affected by decision.
- Make a decision that is ethical and fair to those affected by it.

Some ethical problems can be avoided simply by using common sense and not focusing solely on the short term at the expense of long term.

Firms with a strong code of ethics can create strong customer and employee loyalty. Furthermore, a firm that values people more than profit and is viewed as operating with integrity and honour is more likely to be a commercially successful business⁴.

Decision Making Model

A general approach to tactical decision making includes:

- Define the problem.
- Identify alternatives, eliminating unfeasible alternatives.
- Identify costs & benefits of each alternative.
- Examine total relevant costs, benefits of each alternative.
- Assess non-financial factors and ethical issues.
- Select alternative with greatest overall benefit.

Application

Step 1: Define the problem	Due to economic down turn, it is not feasible to operate the plant at the normal capacity, at least during the quarter
Step 2: Identify alternatives	<ul style="list-style-type: none"> ▪ Shut down the plant ▪ Operate the plant
Step 3: Identify costs, benefits	Alt 1: <Costs> + Benefits Alt 2: <Costs> + Benefits

Step 4: Total relevant costs & benefits	Alt 1: Relevant <Costs> + Benefits Alt 2: Relevant <Costs> + Benefits Differential Cost
Step 5: Assess non-financial factors	<ul style="list-style-type: none"> ▪ Interest of workers. ▪ Re-establishment of the market for the product. ▪ Plant may get rusted.
Step 6: Make decision	Operate the plant

(2. Source: *Managerial Accounting: The Cornerstone of Business Decision-Making* By Maryanne M. Mowen, Don R. Hansen, Dan L. Heitger; 3. *Financial & Managerial Accounting* By Carl S. Warren, James M. Reeve, Jonathan Duchac; 4. *Cost Management: Accounting and Control* By Don Hansen, Maryanne Mowen, Liming Guan)

Illustration

Recently, Ministry of Health and Family Welfare along with Drug Control Department have come hard on health care centres for charging exorbitant fees from their patients. Human Health Care Ltd. (HHCL), a leading integrated healthcare delivery provider company is feeling pinch of measures taken by authorities and facing margin pressures due to this. HHCL is operating in a competitive environment so; it's difficult to increase patient numbers also. Management Consultant of the company has come out with some plan for cost control and reduction.

HHCL provides treatment under package system where fees is charged irrespective of days a patient stays in the hospital. Consultant has estimated 2.50 patient days per patient. He wants to reduce it to 2 days. By doing this, consultant has targeted the general variable cost of ₹500 per patient day. Annually 15,000 patients visit to the hospital for treatment.

Medical Superintendent has some concerns with that of Consultant's plan. According to him, reducing the patient stay would be detrimental to the full recovery of patient. They would come again for admission thereby increasing current readmission rate from 3% to 5%; it means readmitting 300 additional patients. Company has to spend ₹25,00,000 more to accommodate this increase in readmission. But Consultant has found blessing in disguise in this. He said every readmission is treated as new admission so it would result in additional cash flow of ₹4,500 per patient in the form of admission fees.

Required

- (i) CALCULATE the impact of Management Consultant's plan on profit of the company.
- (ii) Also COMMENT on result and other factors that should be kept in mind before taking any decision.

Solution

(i) Impact of Management Consultant's Plan on Profit of the HHCL

Human Health Care Ltd.
Statement Showing Cost Benefit Analysis

Particulars	₹
Cost:	
Incremental Cost <i>due to</i> Increased Readmission	25,00,000
Benefit:	
Saving in General Variable Cost <i>due to</i> Reduction in Patient Days [15,000 Patients × (2.5 Days – 2.0 Days) × ₹500]	37,50,000
Revenue from Increased Readmission (300 Patients × ₹4,500)	13,50,000
Incremental Benefit	26,00,000

(ii) Comment

Primary goal of investor-owned firms is shareholder wealth maximization, which translates to stock price maximization. Management consultant's plan is looking good for the HHCL as there is a positive impact on the profitability of the company (refer Cost Benefit Analysis).

Also HHCL operates in a competitive environment so for its survival, it has to work on plans like above.

But there is also the second side of a coin that cannot also be ignored i.e. humanity values and business ethics. Discharging patients before their full recovery will add discomfort and disruption in their lives which cannot be quantified into money. There could be other severe consequences as well because of this practice. For gaining extra benefits, HHCL cannot play with the life of patients. It would put a question mark on the business ethics of the HHCL.

May be HHCL would able to earn incremental profit due to this practice in *short run* but It will tarnish the image of the HHCL which would hurt profitability in the *long run*.

So, before taking any decision on this plan, HHCL should analyze both *quantitative as well as qualitative factors*.



SOME APPLICATIONS OF CVP ANALYSIS AND COST CONCEPTS

Short run decisions are many and varied but some of the more important ones, **we shall look in this chapter include:**

- Out Sourcing Decision
- Sell or Further Process
- Minimum Pricing Decisions

- Keep or Drop Decisions
- Special Order Decisions
- Product Mix Decision

Outsourcing Decision⁵

Outsourcing decision is often called a 'make or buy' decision. It involves a decision of whether to continue 'making' a product versus 'buying' it from an external firm. Outsourcing enables a firm to

- reduce costs or
- benefit from supplier efficiencies

Outsourcing decision requires *incremental analysis*. The incremental amounts are based on the difference in the *cost of buying a product or service* compared to the *cost of producing the item or providing the service in house*.

Incremental costs are the additional costs incurred from outsourcing. The main cost is the purchase price of the products or the cost of the services that are being provided by external firms.

Incremental cost savings are reductions of costs that will no longer be incurred as a result of outsourcing. They are often called avoidable costs because if a company outsources, it can 'avoid' certain costs. Variable product cost savings are always incremental. Because they reduce total costs, they cause profits to increase. In some circumstances, a portion of fixed costs can be saved such as equipment rental costs or supervisor salaries that can be avoided.

Opportunity costs are the costs forgone as a result of selecting a different alternative. They are always incremental. For example, if a company decides to outsource, it is able to lease its factory space that the product being outsourced no longer will occupy.

Outsourcing Decisions- Accept or Reject?

If incremental cost savings + opportunity costs < incremental costs, reject the outsourcing, unless qualitative factors fiercely impact the decision.

If incremental cost savings + opportunity costs > incremental costs, accept the outsourcing unless qualitative factors fiercely impact the decision.

If incremental cost savings + opportunity costs are = incremental costs, focus primarily on qualitative factors to evaluate the decision.

Qualitative Factors

While considering the decision to Outsourcing the management should consider qualitative aspects like quality of goods, reliability of suppliers, impact on the customers and suppliers etc.

A firm generally decides to **outsource**:

- If it costs less rather than to manufacture it internally;
- If the return on the necessary investment to be made to manufacture is not attractive enough;
- If the company does not have the requisite skilled manpower to make;
- If the concern feels that manufacturing internally will mean additional labour problem;
- If adequate managerial manpower is not available to take charge of the extra work of manufacturing;
- If the component shows much seasonal demand resulting in a considerable risk of maintaining inventories;
- If transport and other infrastructure facilities are adequately available;
- If the process of making is confidential or patented;
- If there is risk of technological obsolescence for the component such that it does not encourage capital investment in the component.

Illustration

DBA, manufactures and sells 25,000 table fans annually. One of the components required for fans is purchased from an outside supplier at a price of ₹190 per unit. Annually it is purchasing 25,000 components for its usage. The Production Manager is of the opinion that if all the components are produced at own plant, it is possible to maintain better quality in the finished product. Further, he proposed that the in-house production of the component with other items will provide more flexibility to increase the annual production by another 5,000 units. He estimates the cost of making the component as follows:

	₹ per unit
Direct materials	80
Direct labour	75
Factory overhead (70% variable)	40
Total cost	195

The proposal of the Production Manager was referred to the Marketing Manager for his remarks. He pointed out that to market the additional units, the overall unit price should be reduced by 5% and additionally ₹1,00,000 p.m. should be incurred for advertising. Present selling price and contribution per fan are ₹2,500 and ₹600 respectively. No other increase or decrease in all other expenses as a result of this proposal will arise.

Required

Since the making cost of the component is more than the buying cost, the Management asks you to:

- (i) ANALYSE the make or buy decision on unit basis and total basis.
- (ii) RECOMMEND the most profitable alternative.

Solution

- (i) DBA purchases 25,000 units of components to manufacture 25,000 fans annually. The external purchase price per component is ₹190 per unit. It has the option of manufacturing these components in house. The cost structure of manufacturing these components would be as below:

Cost Structure	Cost per component unit (₹)
Direct Materials	80
Direct Labor	75
Variable Factory Overhead (70% of ₹40)	28
Total	183

Analysis

If DBA decides to manufacture the components in-house, the following would be the financial impact:

- (a) Production Capacity will increase from 25,000 fans to 30,000 fans.
- (b) Variable Cost of Production of fan would be ₹1,710 [(2,500 - 600) - 190] per unit.
- (c) Fixed Factory Overhead of ₹12 per component would be incurred irrespective of whether component is produced or not. Therefore, this cost is not considered.
- (d) Increase in advertising expense would be ₹100,000 per month or ₹12,00,000 annually.
- (e) Overall selling price would reduce from the current rate of ₹2,500 per fan to ₹2,375 (95% of ₹2,500) per fan.
- (f) Current contribution considering a procurement price of ₹190 per component unit, is ₹600 per fan. As calculated above, if produced in house, the variable cost would be ₹183 per component unit. This would result in an increase in contribution by ₹7 per fan (procurement price of ₹190 per component unit less variable cost of ₹183 per component unit). In addition, there is an impact of ₹125 on account of reduction in selling price. Therefore, the contribution if component produced in house would be ₹482 per fan (₹600+₹7-₹125).

To summarize the above figures:

Particulars	Procurement 25,000		Produce 30,000	
	Components		Components	
	Per Fan ₹	Total ₹	Per Fan ₹	Total ₹
Selling price per fan	2,500	6,25,00,000	2,375	7,12,50,000
Contribution per fan	600	1,50,00,000	482	1,44,60,000

Therefore, incremental loss by switching to in house production (on a total basis) would be ₹17,40,000 (incremental loss ₹5,40,000 – additional advertising expenses ₹12,00,000). On a per unit basis, it would result in a **loss of ₹58 per fan**.

(ii) Recommendation

As explained above, if production increases from 25,000 fans to 30,000 fans, it would not be profitable to make these components in house. Overall profit decreased by ₹17,40,000. However, DBA may prefer to make component, even though it could be financially beneficial to buy from outside supplier. Sometimes qualitative factors become very important and can override some financial benefit. This can be coupled with uncertainty about the supplier's ability or intention to maintain the price, quality, delivery dates of the components etc.

Alternatively, DBA may continue with the sale of 25,000 units without any price reduction and advertising expenses. The component required for the 25,000 fans may be produced internally at a cost of ₹183 per unit. In this situation, the contribution shall be increased by ₹1,75,000 (₹7 × 25,000 units).

Thus, DBA may choose the alternative after due and careful consideration of the facts illustrated above.

Sell or Further Process

Sell or process further refers to a decision-making situation where an executive has to decide either to sell a component/ product/ raw material as it is or alternatively process it further by incurring additional expenses. For instance, sometime, a redundant material lying in stores for a long time may be sold as scrap at a small value or may be thrown away as waste. This material may, however, be converted into a product of higher saleable value by carrying out some further operations or processes. On further processing the component/product/raw material may not only be improved or reconditioned but will mostly fetch a higher sale value as well. Here if the *differential sales value is more than the further processing cost*, then it is beneficial to process the product further otherwise sell it without further processing. Such type of decision making problems usually arise in the case of joint products.

There are two rules to follow when ascertaining whether the further processing is worthwhile:

- Only the incremental costs and revenues of the further process are relevant
- The joint process costs are irrelevant - they are already 'sunk' at the point of separation

Qualitative Factors

Qualitative factors related to processing further decisions include resource availability such as the readiness of employees to work extra hours to further process the products and availability of materials required for the processing. In addition, the influence on customers that prefer the original product should also be considered, as sales to these customers may be lost to competitors.

Example

A process industry unit manufactures three joint products: A, B and C. C has no realisable value unless it undergoes further processing after the point of separation. The cost details of C are as follows:

₹ / p.u.	
Upto point of separation	
Marginal cost	30
Fixed Cost	20
After point of separation	
Marginal cost	15
Fixed cost	5
	70

C can be sold at ₹ 37 per unit and no more.

Cost incurred on Product 'C' *upto point of separation* is irrelevant for decision making as Product 'C' is a Joint Product. Joint Products are the result of same raw material & same process Operations.

Cost incurred *after point of separation* will be considered for decision making as *specifically* incurred for Product 'C'.

After further processing Product 'C' will *contribute* ₹17 per unit toward 'Joint Production Cost'.

Calculation is as follows

Particulars	Amount (₹)
Selling Price <i>per unit</i>	37.00
Less: Cost after separation:	
Marginal Cost <i>per unit</i>	15.00
Fixed Cost <i>per unit</i>	5.00
Contribution toward 'Joint Production Cost'	17.00

Hence, *further processing* of Product 'C' is recommended.

If Product 'C' is not a joint product with same cost structure. In this case there will be *negative contribution* on production of Product 'C'. The calculation is as follows→

Particulars	Amount (₹)
Selling Price <i>per unit</i>	37.00
Less: Marginal Cost (₹30 + ₹15)	45.00
Contribution	(8.00)

Hence, production of Product 'C' will not be recommended.

Minimum Pricing Decisions

The minimum pricing approach is a useful method in situations where there is a lot of intense competition, surplus production capacity, clearance of old inventories, getting special orders and/or improving market share of the product.

The minimum price should be set at the incremental costs of manufacturing, plus opportunity costs (if any).

For this type of pricing, the selling price is the lowest price that a company may sell its product at usually the price will be the *total relevant costs of manufacturing*.

Illustration

XL Polymers, located in Sahibabad Industrial Area, manufactures high quality industrial products. AT Industries has asked XL Polymers for a special job that must be completed within one week.

Raw material R_1 (highly toxic) will be needed to complete the AT Industries' special job. XL Polymers purchased the R_1 two weeks ago for ₹7,500 for a job 'A' that recently was completed. The R_1 currently in stock is the excess from that job and XL Polymers had been planning to dispose of it. XL Polymers estimates that it would cost them ₹1,250 to dispose of the R_1 . Current replacement cost of R_1 is ₹6,000.

Special job will require 250 hours of labour G_1 and 100 hours of labour G_2 . XL Polymers pays their G_1 and G_2 employees ₹630 and ₹336 respectively for 42 hours of work per week.

XL Polymers anticipates having excess capacity of 150 [G_1] and 200 [G_2] labour hours in the coming week. XL Polymers can also hire additional G_1 and G_2 labour on an hourly basis; these part-time employees are paid an hourly wage based on the wages paid to current employees.

Suppose that material and labour comprise XL Polymers's only costs for completing the special job.

Required

CALCULATE the 'Minimum Price' that XL Polymers should bid on this job?

Solution

Opportunity Cost of Labour - The G_2 labour has zero opportunity cost as there is no other use for the time already paid for and is available. However, XL Polymers needs to pay an additional amount for G_1 labour. This amount can be save if the special job were not there.

G₁ labour:

Hours Required	250
Hours Available	<u>150</u>
Extra Hours Needed	100
Cost per hour (₹630/42hrs)	<u>₹15</u>
Opportunity Cost	₹1,500

Thus, the 'Opportunity Cost of Labour' for completing the special job is ₹1,500.

Opportunity Cost of Material – XL Polymers has no alternative use for the R₁, they must dispose of it at a cost of ₹1,250. Thus, XL Polymers actually saves ₹1,250 by using the materials for the AT Industries' special job. Consequently, the 'Opportunity Cost of Material' is - ₹1,250 (i.e., the opportunity cost of this resource is negative).

The *minimum price* is the price at which XL Polymers just recovers its 'Opportunity Cost'. XL Polymers's 'Total Opportunity Cost' is ₹250 (₹1,500 – ₹1,250). Accordingly, minimum Price for the Special Job is ₹250.

Keep or Drop Decisions⁵

Another type of operating decision that management must make is whether to keep or drop unprofitable segments, such as product lines, services, divisions, departments, stores, or outlets.

The decision is based on whether or not the segment's revenue exceeds the costs directly traceable to the segment, including any direct fixed costs.

Incremental Revenue

- Incremental revenue is the difference in revenue between the original sales revenue and the new revenue that is expected to result due to dropping a segment.
- If dropping a product will cause an increase in demand for another product, the additional revenue for the other product should be taken into consideration.

Incremental Cost Savings

- Variable costs associated with a segment to be dropped are incremental cost savings that cause profit to increase.
- Direct fixed costs related to a segment being dropped are avoidable if that segment is dropped because they can be eliminated if the segment is dropped.

Opportunity Costs

Opportunity costs are common in keep or drop decisions. They often arise due to rental of production space that will become vacant if the decision is made to drop a product. Opportunity costs are always incremental.

Decision - Keep or Drop?

- If incremental cost savings > incremental revenue lost, the segment should be dropped, unless qualitative characteristics fiercely impact the decision.
- If incremental revenue lost = incremental cost savings, qualitative effects must be used to make the decision.
- If incremental cost savings < incremental revenue lost, the segment should not be dropped, unless qualitative characteristics fiercely impact the decision.

Qualitative Factors

Qualitative factors related to keep or drop decisions often include considerations of employees that will be terminated if the product is dropped, the effect a lay off might have on employees that are not terminated, effects of suppliers from which the materials needed for the product will no longer be purchased, and the effect of customers who previously purchased the product being dropped.

Illustration

Rabi Ltd. is considering the discontinuance of Division C. The following information is given:

Particulars	Divisions A & B	Division C	Total
Sales (Maximum achievable) (₹)	41,40,000	5,17,500	46,57,500
Less: Variable cost (₹)	20,70,000	2,76,000	23,46,000
Contribution (₹)	20,70,000	2,41,500	23,11,500
Less: Specific avoidable fixed cost (₹)	14,49,000	4,14,000	18,63,000
Divisional Income (₹)	6,21,000	(1,72,500)	4,48,500

The rates of variable costs are 90% of the normal rates due to the current volume of operation. There is adequate market demand.

For any lower volume of operation, the rates would go back to the normal rates.

Facilities released by discontinuing Division C cannot be used for any other purpose.

Required

COMMENT on the decision to discontinue Division C using relevant cost approach.

Solution

As given in the problem Rabi Ltd. is considering to discontinue the Division C perhaps by seeing the Division C's income as it is a loss of ₹1,72,500. Discontinuance of Division C might be saving ₹4,14,000 on specific fixed costs to the company but due to this decision company will not only be losing ₹2,41,500 contribution from the Division C but also an additional burden of variable cost of ₹2,30,000 to Divisions A & B and Rabi Ltd. as a whole.

Let assess the decision of the Rabi Ltd. with the help of the **Relevant Cost** approach.

Particulars	Amount (₹)
Savings Due to Discontinuance	
Specific Fixed Cost	4,14,000
Total ... (A)	4,14,000
Loss/ Increase in Cost Due to Discontinuance	
Loss of Contribution	2,41,500
Increase in Variable Cost $\left(\frac{₹20,70,000}{90} \times 10 \right)$	2,30,000
Total ... (B)	4,71,500
Excess of Loss Over Savings ... (B) – (A)	57,500

In a nutshell considering the above analysis we can conclude that the decision of discontinuing Division C will not be beneficial for the Rabi Ltd and it should review its decision on the basis of relevant cost approach to reach at right decision.

Special Order Decisions⁵

Special order decisions focus on whether a special priced order should be accepted or rejected. These orders often can be attractive, especially when the firm is *operating below its maximum productive capacity*.

Price discrimination laws require that firms sell identical products at the *same price to competing customers* in the same market. This law does not apply to

- Noncompeting customers from the same market.
- Potential customers in markets not ordinarily served.

Special order decisions are based on incremental analysis. Incremental analysis enables managers to emphasis on the *relevant areas of a decision*.

- Incremental revenues are the additional revenues generated from accepting the special order. The revenue can result from additional sales of products or from providing services.

If the company is operating at less than capacity, revenue of regular customers will not be affected.

If the company is operating at capacity, it will have to give up some regular sales in order to provide the special order.

- Incremental costs are the additional costs incurred from accepting a special order. Variable operating costs include special packing, commissions, and shipping costs.

Most often, a firm's recurring fixed costs will remain the same in total if a special order is accepted.

Occasionally the acceptance of a special order may cause additional fixed costs such as special purpose tool, Inspection Cost. In these cases, these additional fixed costs are relevant and should be considered in an incremental analysis.

Decision - Accept or Reject?

- *If incremental revenue < incremental cost, reject the special order, unless qualitative characteristics fiercely impact the decision.*
- *If incremental revenue = incremental cost, qualitative effects must be used to make the decision.*
- *If incremental revenue > incremental cost, accept the order, unless qualitative characteristics fiercely impact the decision.*

Dangers of Concentrating Excessively on a Short-Run Time Horizon⁶

All of the costs and revenues are relevant to the decision because some of the costs that were fixed in the short term could be changed in the longer term. Therefore, whether or not a cost is relevant often depends on the time horizon under consideration. Thus, it is vital that the information presented for decision-making relates to the appropriate time horizon. If inappropriate time horizons are selected there is a risk that misleading information will be presented. Our aim should always be to maximize long-term net cash inflows.

Utilizing the idle capacity to increase the range of products produced, the production process more complex and consequently the fixed costs of handling the additional complexity will ultimately increase.

Long-term considerations should therefore always be taken into account when special pricing decisions are being evaluated. In particular, there is a danger that a series of special orders will be evaluated independently as short-term decisions. Consequently, those resources that cannot be adjusted in the short term will be treated as irrelevant for each decision. However, the effect of accepting a series of successive special orders over several periods constitutes a long-term decision. If special orders are always evaluated as short-term decisions a situation can arise whereby the decision to reduce capacity is continually deferred.

If demand from normal business is considered to be permanently insufficient to utilize existing capacity, then a long-term capacity decision is required. This decision should be based on a comparison of the relevant revenues and costs arising from using the excess capacity for special orders with the capacity costs that can be eliminated if the capacity is reduced.

Illustration

BNZ Ltd. is engaged in the manufacture of plastic bottles of a standard size and produced by a joint process of machines. The factory has 5 machines and capable of producing 40 bottles per hour. The variable cost per bottle is ₹0.32 and the selling price is ₹0.80 each. The company has received an offer from another company for manufacture of 40,000 units of a plastic moulded toy. The price per toy is ₹30 and the variable, cost is ₹24 each. In case of the company takes up the job, it has to meet the expenses of making a special mould required for the manufacture of the toy. The cost of the mould is ₹1,00,000. The company's time study analysis shows that the machines

can produce only 16 toys per hour. The company has a total capacity of 10,000 hours during the period in which the toy is required to be manufactured. The fixed costs excluding the cost of construction of the mould during the period will be ₹10 Lakh.

The company has an order for the supply of 3,00,000 bottles during the period.

Required

- (i) Do you ADVISE the company to take up the order for manufacturing plastic moulded toys during the time when it has an order in its book for the supply of 3,00,000 bottles.
- (ii) If the order for the supply of bottles increases to 4,00,000 bottles, will you ADVISE the company to accept the order for the supply of plastic moulded toys? State the reasons.
- (iii) An associate company of BNZ Ltd. has idle capacity and is willing to take up the whole or part of the manufacturing of the plastic moulded toys on sub-contracting basis. The subcontract price inclusive of the cost of construction of mould is ₹28 per toy. DETERMINE the minimum expected excess machine hour capacity needed to justify producing any portion of the toy order by the company itself rather than subcontracting.

Solution

Workings

Statement Showing "Contribution / Machine Hour"

	'Bottle'	'Toy'
Demand (units)	3,00,000	40,000
Sales (₹/u)	0.80	30.00
Less: Variable Cost (₹/u)	0.32	24.00
Less: Specific Fixed Cost (₹/u)	---	2.50
Contribution (₹/u)	0.48	3.50
Machine Hours Required per unit	0.025	0.0625
Contribution / Machine Hour	19.20	56.00

Advice on Supply of 3,00,000/ 4,00,000 Bottles

- (i) BNZ Ltd. can accept plastic moulded toy's order as sufficient number of hrs. i.e. 2,500 hrs. (10,000 hrs.- 3,00,000 bottles × 0.025 hrs.) are available and would be able to generate additional benefit of ₹3.50 per unit on 40,000 units of toys i.e. ₹1,40,000.
- (ii) If the order for the supply of bottles increases to 4,00,000 bottles, then 2,500 more hrs. will be required to produce the additional bottles. BNZ Ltd. has to decide whether to utilize 2,500 hrs. for existing bottle order or for toy Order.

Machine time is limiting factor. Therefore, contribution per machine hour from both the activities (i.e. bottles and toys) should be calculated to decide whether the order should be accepted. Contribution per hour is more in case of toys (refer workings). Therefore, BNZ Ltd. should utilize the remaining 2,500 hours for manufacturing toys rather than to fulfil the order for supply of additional bottles.

Prioritizing production based on contribution per machine hour would maximize profits. *However, existing order fulfilment is necessary for building long term and sustainable customer relationship.* Developing and maintaining long term and intimate relationships with the profitable customers provides valuable benefits to the company as the relationships between company and customers grow, a customer who is satisfied with the company's products and services, tends to commit the relationship, and buy more over time. *Cost of keeping the existing customers is less expensive than the cost of acquiring new customers.*

Hence, BNZ Ltd. should be taken into consideration long term supplier relation before accepting the toy order based on financial consideration as contribution per hour is more in case of toys. Further, company may also explore outsourcing opportunities for production of toys.

- (iii) Minimum number of toys needed to be manufactured to justify the increase in fixed cost of ₹1,00,000 to make the mould is 25,000 toys {1,00,000/ (₹28 - ₹24)}. Thus, as long as company has excess capacity available to manufacture more than 25,000 toys it is cheaper to produce than to buy from subcontractor.

$$\text{Minimum Expected Excess Capacity hours to justify} = \left(\frac{25,000 \text{ toys}}{16 \text{ toys}} \right) = 1,562.5 \text{ or } 1,563 \text{ hrs.}$$

Product Mix Decision

Many times, the management has to take a decision whether to produce one product or another instead. Generally, decision is made on the basis of contribution of each product. Other things being the same the product which yields the highest contribution is best one to produce. But, if there is shortage or limited supply of certain other resources which may act as a key factor like for example, the machine hours, then the *contribution is linked with such a key factor for taking a decision.* For example, in an undertaking the availability of machine capacity is limited and the machine hours required for one unit of the two products are different. In such cases the contribution is to be linked with the machine hour and the product which yields the highest contribution per machine hour is to be preferred for taking decision.

Illustration

A company manufactures two products. Each product passes through two departments A and B before it becomes a finished product. The data for the year are as under:

	Product X	Product Y
Maximum Sales Potential (in units)	7,400	10,000
Product unit data:		
Selling Price p.u.	₹90	₹80
Machine hrs. p.u.		
Department A hrs. @ ₹40/ hr.	0.50	0.30
Department B hrs. @ ₹60/ hr.	0.40	0.45

Maximum Capacity of Department A is 3,400 hrs. and Department B is 3,640 hrs.

Maximum Quantity of Direct Materials available is 17,000 kgs. Each product requires 2 kg. of Direct Materials. The Purchase Price of direct materials is ₹5/ kg.

Required

- Find optimum product mix.
- In view of the aforesaid production capacity constraints, the company has decided to produce only one of the two products during the year. Which of the two products should be produced and sold in the year to maximise profit? Find the number of units of that product and relevant contribution.

Solution

(i) Calculation of Optimum Production Mix

Statement Showing Limiting Factor

Particulars	Material	Hours in Department A	Hours in Department B
Required: X	14,800 kg.	3,700 hrs.	2,960 hrs.
Required: Y	20,000 kg.	3,000 hrs.	4,500 hrs.
Total Requirement	34,800 kg.	6,700 hrs.	7,460 hrs.
Available Resources	17,000 kg.	3,400 hrs.	3,640 hrs.
Shortage	17,800 kg.	3,300 hrs.	3,820 hrs.

Hence all the three resources are limiting factors.

Statement of Rank

Particulars	Product X	Product Y
Sales	90	80
Less: Direct Material	10	10
Dept. A	20	12
Dept. B	24	27

Contribution p.u.	36	31
Contribution per kg. of Raw Material	18	15.5
Rank	I	II
Contribution /hr. of Dept. A	72	103.33
Rank	II	I
Contribution /hr. of Dept. B	90	68.89
Rank	I	II

To find the optimum mix of products that shall lead to maximum profits while taking into consideration of shortage of resources (i.e. constraints), we have to use **Linear Programming**.

Let x_1 and x_2 denote quantities of product 'x' and product 'y' respectively.

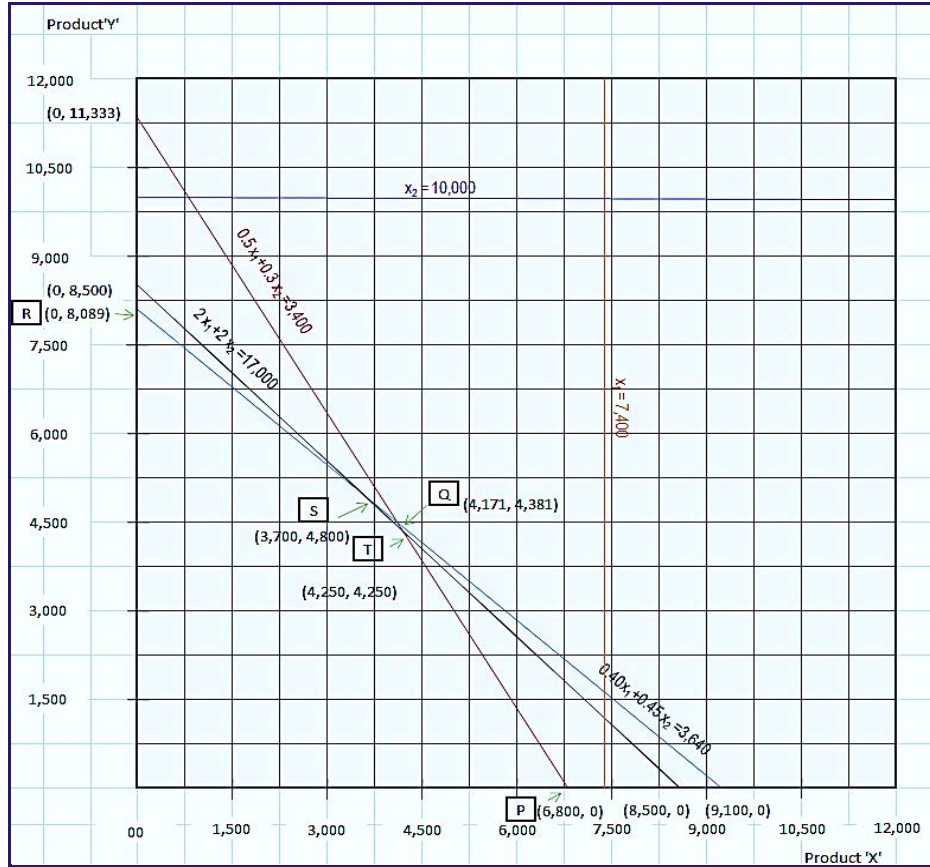
The linear programming model for the given problem is:

$$Z_{\max} = 36x_1 + 31x_2$$

Subject to:

$$\begin{aligned} 2x_1 + 2x_2 &\leq 17,000 && \dots(\text{for material}) \\ 0.5x_1 + 0.3x_2 &\leq 3,400 && \dots(\text{for dept. A}) \\ 0.4x_1 + 0.45x_2 &\leq 3,640 && \dots(\text{for dept. B}) \\ x_1 &\leq 7,400 && \dots(\text{demand constraint}) \\ x_2 &\leq 10,000 && \dots(\text{demand constraint}) \end{aligned}$$

The graphical solution for the problem is given below:



So, different combinations of product mix include,

Combination	x ₁	x ₂	Total Contribution (in ₹)	Rank
P	6,800	0	2,44,800	IV
Q*	4,171	4,381	2,85,967	-
R	0	8,089	2,50,759	III
S	3,700	4,800	2,82,000	II
T	4,250	4,250	2,84,750	I

Note (*)

Combination Q (4,171, 4,381) is not possible as it is satisfying three conditions out of above four conditions. To produce combination Q (4,171, 4,381), requirement of the material will be 17,104 Kgs. (2 Kg × 4,171 units + 2 Kg × 4,381 units). However, material is available 17,000 Kgs. Accordingly, this combination is not possible.

Therefore, optimum product mix = X 4,250 units and Y 4,250 units.

(ii) Statement Showing Product with Higher Contribution

Product	Maximum Demand (a)	Maximum Production by Dept. A (b)	Maximum Production by Dept. B (c)	Maximum Production with available materials (d)	Feasible Maximum Production (lower of a, b, c and d)	Contribution (₹)
X	7,400	6,800	9,100	8,500	6,800	2,44,800
Y	10,000	11,333	8,089	8,500	8,089	2,50,759

Therefore, Product Y should be produced at 8,089 units resulting in a contribution of ₹ 2,50,759.

(Sources 5- Managerial Accounting: The Cornerstone of Business Decision-Making By Maryanne M. Mowen, Don R. Hansen, Dan L. Heitger; <http://www.unf.edu/>; 6-Management Accounting for Business By Colin Drury)



SUMMARY

- CVP analysis involves analysing the interrelationships among revenues, costs, levels of activity, and profits. It helps in planning, controlling decisions and evaluating decisions.
- Conventional CVP analysis assumes volume based measures. Activity based costing provides a more accurate determination of costs because it separately identifies and traces non-unit based costs to products rather than combining them in a pool of fixed costs as volume based approach does.
- The Break-even can then be expressed as follows:

$$\text{Break-even units} = \frac{[\text{Fixed costs} + (\text{Setup cost} \times \text{Number of Setups}) + (\text{Engineering Cost} \times \text{Number of Engineering Hours})]}{(\text{Price} - \text{Unit Variable Cost})}$$
- A comparison of the ABC break-even point with the conventional break-even point reveals two important differences. First, the fixed costs differ. Some costs previously identified as being fixed may actually vary with non-unit cost drivers, in this case setups and engineering hours. Second, the numerator of the ABC break-even equation has two non-unit-variable cost terms: one for batch-related activities and one for product-sustaining activities.
- Cost-Volume-Profit analysis suffers from a limitation that it does not consider adjustments for risk and uncertainty. A possible approach by which uncertainty can be incorporated into the analysis is to apply normal distribution theory. The analysis can be changed to include fixed cost, variable cost and selling price as uncertain variables. The effect of treating these variables as uncertain will lead to an increase in the standard deviation because the variability of the variable cost, fixed cost and selling price will add to the variability of profits.
- To apply CVP analysis in service and non-profit organisations, we need to focus on measuring their output, which is different from tangible units sold by manufacturing and merchandising companies.

- Short run decision making – Based on relevant costs, Short run in nature, referred to as tactical decisions, choosing among alternatives, often have long run consequences, immediate or limited time frame, small scale actions that serve a larger purpose.
- For a cost to be relevant to a decision it must be
 - A future cost, i.e. related to the future.
 - A differential Cost, i.e. its level must be different for each of the alternatives under consideration.

Accordingly, only future costs can be relevant to decisions. However, to be relevant, a cost must not only be a future cost but must also differ from one alternative to another. If a future cost is the same for more than one alternative, it has no effect on the decision. Such a cost is irrelevant cost.

- Non- Financial information which a company should focus that would turn out to be advantageous while making decisions for a company are: Quality, Employee Satisfaction, Customer Satisfaction, Corporate Social Responsibility, Environmental Factors, Intellectual Property, Intangible Assets, Competitor's Movements, Brand Name.
- Ethics are moral principles that guide the conduct of individuals. By their behaviour and attitude, managers set the company culture.
- Guideline for Ethical Conduct: Identify an ethical decision by using personal ethical standards of honesty and fairness, Identify the consequences of the decision and its effect on others, consider obligations and responsibilities to those that will be affected by decision, make a decision that is ethical and fair to those affected by it.
- Decision Making Model – Define the problem, identify alternatives, eliminating unfeasible alternatives, identify costs & benefits of each alternative, examine total relevant costs, benefits of each alternative, assess non-financial factors and ethical issues, select alternative with greatest overall benefit.
- Some Common Applications –
 - (a) Out Sourcing Decision – A 'make or buy' decision requires incremental analysis.
 - If incremental cost savings + opportunity costs < incremental costs, reject the outsourcing, unless qualitative factors fiercely impact the decision.
 - If incremental cost savings + opportunity costs > incremental costs, accept the outsourcing unless qualitative factors fiercely impact the decision.
 - If incremental cost savings + opportunity costs are = incremental costs, focus primarily on qualitative factors to evaluate the decision.
 - (b) Sell or Further Process – To decide either to sell a component/ product/ raw material as it is or alternatively process it further by incurring additional expenses usually in the case of joint products. Only the incremental costs and revenues of the further process are relevant. The joint process costs are irrelevant - they are already 'sunk' at the point of separation

- (c) Minimum Pricing Decisions – Relevant where there is a lot of intense competition, surplus production capacity, clearance of old inventories, getting special orders and/or improving market share of the product. The minimum price should be set at the incremental costs of manufacturing, plus opportunity costs (if any).
- (d) Keep or Drop Decisions – The decision is based on whether or not the segment's revenue exceeds the costs directly traceable to the segment, including any direct fixed costs.
- (e) Special Order Decisions – Whether a special priced order should be accepted or rejected. Relevant if the firm is operating below its maximum productive capacity. Price discrimination laws require that firms sell identical products at the same price to competing customers in the same market. This law does not apply to - Noncompeting customers from the same market and Potential customers in markets not ordinarily served.
- (f) Product Mix Decision – Other things being the same the product which yields the highest contribution is best one to produce. But, if there is shortage or limited supply of certain other resources which may act as a key factor like for example, the machine hours, then the contribution is linked with such a key factor for taking a decision.

TEST YOUR KNOWLEDGE

Decision Making

1. 'S' manages the school canteen (approximately 1,600 students) at Noida. The current cash payment system requires three clerks (paid ₹90 per hour), employed for about 4 hours a day. The canteen operates approximately 240 days a year.

'S' is considering a Wireless Cash Management System (WCMS), where a student could just swipe an ID Card for payment. This system would cost ₹1,25,000 to setup and ₹36,000 per year to operate. 'S' believes that he could manage with one clerk if he were to implement the system.

Required

ADVISE 'S' on the choice of a plan, assuming working life of WCMS as 5 years. (Ignore the time value of money)

2. Aayla runs the Planetarium Station in New Delhi, India. The strength of the station lies in its live interactions and programs for visitors, students and amateur astronomers. The station is always active with programs for school and college students and for amateur astronomers. One of the station's key attractions is a big screen IMAX theatre. IMAX is a 70 mm motion picture film format which shows images of far greater size and resolution than traditional film systems. The IMAX cinema projection standards were developed in Canada in the late 1960s. Unlike traditional projectors, the film is run horizontally so that the image width is greater than the width of the film.

The average IMAX show at the station attracts 120 visitors (50 children and 70 adults) at a ticket price of ₹160 for children and ₹200 for adults. Aayla estimates that the running costs per IMAX show are ₹10,000. In addition, fixed costs of ₹7,500 are allocated to each show based on annual estimate of the number of IMAX shows.

The Hobart School has approached Aayla about scheduling an extra show for its class VIII students. One hundred students and five teachers are expected to join the special show on the 'Planets & Solar System', a feature that is currently showing. The school has asked Aayla for a price quote. The special show will take place at 08:30 AM when the IMAX is not usually open.

Required

RECOMMEND the minimum amount that Aayla should charge.

3. Color paints is a manufacturer of industrial dyes. It has received an order for 200 kgs of powder dye that needs to be customized to certain specifications. The job would require the following materials:

Material	Total units required	Units already in inventory	Book value of the units in inventory (₹per unit)	Realizable value (₹per unit)	Replacement cost (₹per unit)
A	2,000	0	NA	NA	8
B	3,000	1,200	7	8	10
C	2,000	1,400	12	9	14
D	500	500	9	12	15

- I) Material B is used regularly in production of all types of dyes that Color paints produces. Therefore, any stock used towards this job order would need to be replaced to meet other production demands.
- II) Inventory of material C and D are from stock that was purchased in excess previously. Material C has no other use other than for this special order. Material D can be used as a substitute for 700 units of material Z which currently costs ₹11 per unit. The company does not have any inventory of material Z currently.

Required

ANALYSE the relevant costs of material while deciding whether to accept the order or not?

4. Diezel, is engaged in manufacturing many chemical products. It is using many chemicals some of which are fast moving, some are slow moving and few are in non-moving category. The firm has a stock of 10 units of one non-moving toxic chemical. Its book value is ₹2,400, realizable value is ₹3,500 and replacement cost is ₹4,200.

One of the customers of the firm asks to supply 10 units of a product which needs all the 10 units of the non-moving chemical as an input. The other costs associated with the production of the product are:

Allocated overhead expenses ₹16 per unit

Out of pocket expenses ₹50 per unit

Labour cost ₹40 per hour. For each unit two hours are required.

Other material cost ₹80 per unit.

The labour force required for the production of the product will be deployed from among the permanent employees of the firm. This temporary deployment will not lead to any loss of contribution.

Required

- (i) RECOMMEND the minimum unit price to be charged to the customer without any loss to the firm.
 - (ii) ANALYSE with reasons for the inclusion or exclusion of each of the cost associated with the production of the product.
 - (iii) ADVISE a pricing policy to be followed by Diezel in perfect competition.
5. Golden Pacific Airlines Ltd. operates its services under the brand 'Golden Pacific'. The 'Golden Pacific' route network spans prominent business metropolis as well as key leisure destinations across the Indian subcontinent. 'Golden Pacific', a low-fare carrier launched with the objective of commoditizing air travel, offers airline seats at marginal premium to train fares across India.

Profits of the 'Golden Pacific' have been decreasing for several years. In an effort to improve the company's performance, consideration is being given to dropping several flights that appear to be unprofitable.

Income statement for one such flight from 'New Delhi' to 'Leh' (GP - 022) is given below (per flight):

	₹	₹
Ticket Revenue (175 seats x 60% Occupancy x ₹ 7,000 ticket price)		7,35,000
Less: Variable Expenses (₹1,400 per person)		1,47,000
Contribution Margin		5,88,000
Less: Flight Expenses:		
Salaries, Flight Crew	1,70,000	
Salaries, Flight Assistants	31,500	
Baggage Loading and Flight Preparation	63,000	
Overnight Costs for Flight Crew and Assistants at destination	12,600	
Fuel for Aircraft	2,38,000	
Depreciation on Aircraft	49,000*	

Liability Insurance	1,47,000	
Flight Promotion	28,000	
Hanger Parking Fee for Aircraft at destination	7,000	7,46,100
Net Gain / (Loss)		(1,58,100)

* Based on obsolescence

The following additional information is available about flight GP-022.

1. Members of the flight crew are paid fixed annual salaries, whereas the flight assistants are paid by the flight.
2. The baggage loading and flight preparation expense is an allocation of ground crew's salaries and depreciation of ground equipment.
3. One third of the liability insurance is a special charge assessed against flight GP-022 because in the opinion of insurance company, the destination of the flight is in a "high-risk" area.
4. The hanger parking fee is a standard fee charged for aircraft at all airports.
5. If flight GP-022 is dropped, 'Golden Pacific' Airlines has no authorization at present to replace it with another flight.

Required

Using the data available, prepare an ANALYSIS showing what impact dropping flight GP-022 would have on the airline's profit.

6. About Aditya Group

Aditya Group was established in 1975, manufactures and sells electronic personal grooming and beauty products. The group has two 100% subsidiaries AUS Ltd. and ANZ Ltd. AUS Ltd. manufactures luxury products that cater to niche customers who prefer specialized personal grooming and beauty care. ANZ Ltd. caters to regular daily beauty and grooming requirements that has a wide reach within the market. Factories of both companies are located within India. The products are sold to wholesalers, who supply these products to the retail market.

Aditya Group purchases its raw material requirements from both domestic and overseas markets. Additionally, certain products manufactured by AUS Ltd. can be enhanced based on the products manufactured by ANZ Ltd. Therefore, as per production requirements, AUS Ltd. sources some product components from ANZ Ltd.

Aditya Group has a centralized decision making set-up. Basic policy decisions for functions such as production planning, sales and client relationship, finance and human resources are handled at the group level. Individual units AUS Ltd. and ANZ Ltd. concentrate on the manufacturing alone.

About You

You are an Assistant Manager in Finance and Accounts department of Aditya Group, headed by Director- Finance Ms. Elsea. You assist and report to Ms. Fiona, Manager of your

department. Sometime you also assist Director Finance in analysing financial and non-financial information, drafting reports for board meetings, preparation of presentation and staff trainings.

Business Situation- 1

Yesterday, 5.15 P.M.

You got an email from Ms. Elsea, with Cc to Ms. Fiona. Ms. Elsea, asked you to prepare a cost statement for making a quotation to a new customer. She has also informed you that the customer can also maintain a long- term business relation with us. You have been requested to gather information related to the specification from Sales Manager.

Yesterday, 5.25 P.M.

You have been called by Ms. Fiona, and provided the product specification received from Sales- Manager for which quotation has to be quoted. Ms. Fiona has also requested you to gather relevant information to prepare cost statement. Due to the expected long term business relationship that AUS Ltd. wants to have with the customer, the sales manager wants to quote the lowest possible price. AUS Ltd. currently has some spare capacity that can be utilized to cater to this entire order. Therefore, only the relevant cost to AUS Ltd. has to be considered to arrive at the quote.

After meeting with your reporting officer, you mailed to various concerned department and requested for data.

The following information has been obtained in relation to the contract:

Today, 10.05 A.M.

You got an e-mail from Production Manager, it has been informed that 40 tonnes of material Dx would be required. This material is in regular use by AUS and has a current purchase price of ₹380 per tonne. Currently, there are 5 tonnes in inventory which cost ₹350 per tonne. The resale value of the material in inventory is ₹240 per tonne.

Further, with regards to components, it has been informed that 4,000 components would be required. These could be bought externally for ₹15 each or alternatively they could be supplied by ANZ Ltd. The variable cost of the component if it were manufactured by ANZ Ltd. would be ₹8 per unit. ANZ Ltd. has sufficient capacity to produce 2,500 components without affecting its ability to satisfy its own external customers. However, in order to make the extra 1,500 components required by AUS Ltd., ANZ Ltd. would have to forgo other external sales of ₹50,000 which have a contribution to sales ratio of 40%. To have uniformity in the quality of the component, it is assumed that AUS Ltd. would procure its entire requirement of 4,000 components either externally or from ANZ Ltd. The transfer pricing policy of Aditya Group for sales between units aims at goal congruence. The unit selling the goods would be allowed to charge any opportunity cost on account of catering to internal demand, while the purchasing unit should ensure that the company is not at a loss.

Today, 10.45 A.M.

You got an e-mail from Personnel Manager, it has been informed that 2,000 high skilled labour hours would be required. The grade of labour required is currently paid ₹5 per hour.

Highly skilled labour is in short supply and cannot be increased significantly in the short-term. This labour is presently engaged in meeting the demand for product 'G', which requires 4 hours of highly skilled labour. The contribution from the sale of one unit of product L is ₹24.

It has also been informed that the contract would require a specialist machine. The machine could be hired for ₹15,000 or it could be bought for ₹50,000. At the end of the contract if the machine were bought, it could be sold for ₹30,000. Alternatively, it could be modified at a cost of ₹5,000 and then used on other contracts instead of buying another essential machine that would cost ₹45,000. The operating costs of the machine are payable by AUS whether it hires or buys the machine. These costs would total ₹12,000 in respect of the new contract.

Supervisor

The contract would be supervised by an existing manager who is paid an annual salary of ₹50,000 and has sufficient capacity to carry out this supervision. The manager would receive a bonus of ₹5,000 for the additional work.

Development Time

15 hours of development time at a cost of ₹30,000 have already been worked in determining the resource requirements of the contract.

Fixed Overhead Absorption Rate

AUS uses an absorption rate of ₹20 per direct labour hour to recover its general fixed overhead costs. This includes ₹5 per hour for depreciation.

Today, 11.15 A.M: Ms. Fiona called you in her place as asked you the following:

Required

- (i) CALCULATE the relevant cost of the contract to AUS. You must present your answer in a schedule that clearly shows the relevant cost value for each of the items identified above. You should also EXPLAIN each relevant cost value you have included in your schedule and why any values you have excluded are not relevant. Ignore taxation and the time value of money.
- (ii) DISCUSS two problems that can arise as a result of setting prices using relevant costing.

Business Situation- 2

Today, 5.26 P.M: A memo from Managing Director of the group has been circulated to all officers of the group which stated "My objective for the forthcoming year is to reduce our quality costs in each of the primary activities in our value chain". The company is keen to build a reputation for quality and gives a five-year guarantee with all of its products.

Today, 5.37 P.M: Ms. Fiona, called you in her place and asked the following:

Required

- (iii) EXPLAIN, by giving examples, how each of the four types of quality cost could be reduced. You should also IDENTIFY in which primary activity each one of your examples would occur in Aditya Group's value chain.

ANSWERS/ SOLUTIONS

1. For each day, 'S' spends ₹360 per clerk (₹90 per hr. × 4 hrs.). Therefore, 'S' spends ₹1,080 per day to employ three clerks. Annually, this outlay amounts to ₹2,59,200 (₹1,080 per day × 240 days).

Over five years, the outlay would be ₹12,96,000. If the WCMS is implemented, the initial cost is ₹1,25,000. If we add the annual cost of ₹36,000, the total cost over five years amounts to ₹3,05,000. Since one clerk will be needed as well, 'S' has to incur ₹4,32,000 over five years to pay clerk (₹4,32,000 = ₹90 × 4 hrs. × 1 clerk × 240 days × 5 years). Therefore, the total cost of this option is ₹7,37,000.

Accordingly, there is cost saving of ₹5,59,000 from WCMS implementation.

Relevant Non-Financial Considerations

The WCMS may be a lot more efficient, but more rigid. For instance, what if, a student forgets to bring his/ her card or transaction failure due to connectivity issue, and may not have enough cash to pay. Automated systems may be less able to handle these situations. Having clerks may add an aspect of flexibility and a human aspect that is hard to quantify.

Conclusion

Obviously, WCMS option is more cost effective for 'S' because there is a cost saving of ₹5,59,000. But, non- financial factors should also be taken into consideration.

2. The incremental cost associated with the IMAX show appears to be ₹10,000 i.e. cost of running the show. The allocated fixed cost per show is not relevant because the total amount of fixed costs for the year will not change as a result of the special show. Further, the stated ticket prices are not relevant because the show will take place at 08:30 AM when the IMAX is not usually open – thus, the students will not be displacing any regular visitors. Based on the financial data provided, the minimum price quote appears to be ₹10,000.

Aayla should consider the following factors:

- Does the station have a souvenir shop and/or cafeteria?
If so, many students are likely to buy food and/or souvenir items, thereby increasing the station's contribution. In turn, this would reduce the minimum price quote.
- What is the impact on future revenue?
After seeing the show, many students may return with their parents, thereby increasing future revenue.
- Are there costs linked with the special showing that are not included in the ₹10,000 variable cost number?

For example, will the station have to pay an overtime premium.

Aayla should also consider the educational mission of the Planetarium Station. Such shows directly contribute to this mission, the station, and, hopefully, the betterment of the students. The special shows may be an excellent way to expose some students to earth science –

these students may have never gone through the Planetarium Station if it were not for the school excursion.

Overall, the “best” price to charge is unclear and requires some judgment as Aayla needs to balance an array of financial and non-financial factors.

3. Material A

The requirement of 2,000 units of Material A has to be purchased in entirety since there are no units in stock. Therefore, the relevant cost will be the replacement cost at ₹8 per unit, which for 2,000 units is ₹16,000 (2,000 units × ₹8 per unit).

Material B

There is a requirement of 3,000 units of Material B, of which 1,200 units are in stock. Material B is used regularly in the production of all types of dyes. If the 1,200 units in stock are used, they need to be replenished (replaced) in order to meet production demands of other dyes. In addition, for the special order, additional 1,800 units of Material B is required to be procured from the market. Therefore, 3,000 units of Material B has to be procured if the special order is undertaken. The relevant cost will be the replacement cost at ₹10 per unit, which for 3,000 units is ₹30,000 (3,000 units × ₹10 per unit).

Material C

There is a requirement of 2,000 units of Material C, of which 1,400 units are in stock. The balance 600 units have to be procured at the replacement (market) price of ₹14 per unit, which would be ₹8,400. Material C has no other use, so if the special order is not undertaken the stock of 1,400 units can be sold at ₹9 per unit. So, the opportunity cost of undertaking this order is ₹12,600. Therefore, the relevant cost for Material C is procurement cost of 600 units plus the opportunity cost of not disposing the current stock of 1,400 units, which would be ₹8,400 + ₹12,600 = ₹21,000.

Material D

The entire requirement of 500 units of Material D is in stock. If the special order is not accepted, Color paints has two options (i) sell the excess material at ₹12 per unit or (ii) use it as a substitute for Material Z, which would otherwise need to be procured.

- (i) The realizable value of Material D is ₹6,000 (500 units × ₹12 per unit).
- (ii) Material D can be used as a substitute for 700 units of Material Z. Since there is no stock of Material Z currently, if the special order is accepted, the entire quantity would have to be procured at ₹11 per unit. This would cost the company ₹7,700 (700 units × ₹11 per unit).

Both options (i) and (ii) represent opportunity cost if the special order is accepted. The relevant cost for Material D, if the special order is accepted would be higher of either of these two opportunity costs. The higher opportunity cost is that of procuring Material Z from the market at ₹7,700. Therefore, the relevant cost for Material D is ₹7,700.

Therefore, the relevant cost to accepting the special order would be the cumulative of the relevant cost for Materials A, B, C, and D. This works out to ₹74,700.

4. (i) Diezel has the opportunity to utilize 10 units of non-moving chemical as input to produce 10 units of a product demanded by one of its customers. The minimum unit price to be charged to the customer would be–

Cost Component	Cost per unit of product (₹)
Cost of Material (Realizable value = ₹3,500 / 10 units of chemical)	350
Out of Pocket Expenses	50
Other Material Cost	80
Minimum Unit Price that can be charged	480

Therefore, the minimum unit price that can be charged to the customer, without incurring any loss is ₹480 per unit of product. As explained below in point (ii), allocated overhead expenses and labor cost are sunk costs that have been ignored while calculating the minimum unit price to be charged.

(ii) Analysis

- (a) **Cost of Material:** Relevant and hence included at realizable value. Diezel has 10 units of non-moving chemical input that has a book value of ₹2,400, realizable value of ₹3,500 and replacement cost of ₹4,200. Realizable value of ₹3,500 would be the salvage value of the chemical had it been sold by Diezel instead of using it to meet the current order. This represents an opportunity cost for the firm and hence included while pricing the product. Book value would represent the cost at which the inventory has been recorded in the books, a sunk cost that has been ignored. Replacement cost of ₹4,200 would be the current market price to procure 10 units of the input chemical. This would be relevant only when the inventory has to be replenished after use. This chemical is from the non-moving category, that means that it is not used regularly in production process and hence need not be replenished after use. Therefore, replacement cost is also ignored for pricing.
- (b) **Labour Cost:** Not relevant and hence excluded from pricing. It is given in the problem that this order would be met by permanent employees of the firm. Permanent employee cost is a fixed cost that Diezel would incur irrespective of whether this order is produced or not. No additional labour is being employed to meet this order. Therefore, this cost is a sunk cost, excluded from pricing.
- (c) **Allocated Overhead Expenses:** These expenses have been incurred at another Cost Centre, typical example would be office and administration costs. Such costs are fixed in nature that would be incurred irrespective of whether this order is produced or not. Therefore, this cost is a sunk cost, excluded from pricing.

- (d) Out of Pocket Expenses: These are expenses that are incurred to meet the production requirement of this order. These are additional variable expenses, that need to be included in pricing.
- (e) Other Material Costs: These are expenses that are incurred to meet the production requirement of this order. These are additional variable expenses, that need to be included in pricing.

(iii) Advice on Pricing Policy

Under perfect competition conditions, Diezel can have no pricing policy of its own, here sellers are price takers. It cannot increase its price beyond the current market price. The firm can only decide on the quantity to sell and continue to produce as long as the marginal cost is recovered. When marginal cost exceeds the selling price, the firm starts incurring a loss.

Since Diezel cannot control the selling price individually in the market, it can adopt the *going rate pricing* method. Here it can keep its selling price at the average level charged by the industry. This would yield a fair return to the firm. An average selling price would help the firm attract a *fair market share* in competitive conditions.

5. As per the statement given in the problem, FlightGP-022 incurs a net (loss) of ₹158,100. This is the net result of revenue less costs. Revenue is entirely variable depending upon passenger occupancy. Costs are both variable and fixed nature. To analyze the impact of dropping flight GP-022, we need to *re-compute* net gain/ (loss) that Golden Pacific earns when it operates the flight **based on relevant costing principles**.

Net Gain/ (Loss) = Revenue earned from flight operations *less* Variable costs of operation

Revenue earned is the ticket revenue earned from flight operations of GP-022, this is entirely variable. Variable costs of flight operations are those expenses that would be incurred only when the flight is operated. These include variable expenses per passenger, salaries flight assistants, overnight costs for flight crew and assistants, fuel for aircraft, a third portion of flight insurance that is specifically related to this flight sector and flight promotion expense. These are expenses that will not be incurred if the flight is not operated. Hence, relevant for decision making.

Other expenses like salaries of flight crew and hanger parking fees for aircraft are fixed expenses that will be incurred even if the flight does not operate. Loading and flight preparation expense is an allocated cost that will continue to be incurred even if flight GP-022 does not operate. Depreciation of aircraft and liability insurance expense (2/3rd portion not related to a specific flight sector) are sunk costs. These expenses have already been incurred and hence are irrelevant to decision making. Therefore, these fixed, allocated and sunk expenses are ignored while analyzing the decision whether to continue operating flight GP-022.

Flight GP-022
Statement Showing Net Gain/ (Loss)

	₹	₹
Contribution Margin <i>if the flight is continued</i>		5,88,000
<i>Less: Flight Costs</i>		
Flight Promotion	28,000	
Fuel for Aircraft	2,38,000	
Liability Insurance (1/3 × ₹1,47,000)	49,000	
Salaries, Flight Assistants	31,500	
Overnight Costs for Flight Crew and Assistants	12,600	3,59,100
Net Gain/ (Loss)		2,28,900

If Golden Pacific Airlines Ltd. discontinues flight GP-022, profits will reduce by ₹2,28,900. The statement showing loss in operations of ₹158,100 is misleading for decision making purpose because it accounts for costs that are fixed and irrelevant. However, since flight GP-022 yields a net gain of ₹2,28,900, flight operations should continue.

6. (i) Statement Showing Relevant Cost

Type of Cost	Explanation	Amount (₹)
Material Dx (40 tonnes × ₹380)	1	15,200
Components	2	52,000
Direct labour (2,000 hrs. × ₹11)	3	22,000
Specialist machine	4	10,000
Machine operating cost	5	12,000
Supervision	6	5,000
Development time	7	Nil
General fixed overhead	8	Nil
Total relevant cost		1,16,200

Explanation

- Material Dx is in regular use by AUS Ltd. and must be replaced. Consequently, its relevant value is its replacement cost. The historical cost is not relevant because it is a past cost and the resale value is not relevant because AUS Ltd. is not going to sell it because the material is in regular use.
- AUS Ltd. would like to procure 4,000 components either from ANZ Ltd. or externally from the market. At the current production level, ANZ Ltd. (seller) has available capacity to accommodate part of AUS Ltd's request to the extent of 2,500 components. At this point, ANZ Ltd. would be operating at its maximum capacity.

To cater to the remaining demand of 1,500 units from AUS Ltd., ANZ Ltd. has to forego external sales of ₹50,000 to its own customers. Given that the contribution to sales ratio is 40%. Therefore, ANZ Ltd. has to forego contribution of ₹20,000 (40% of external sales foregone ₹50,000) in order to cater to AUS Ltd.'s request. Fixed cost at ANZ Ltd. is irrelevant, since it would be incurred irrespective of whether AUS Ltd.'s order to catered to or not.

Therefore, in spirit of goal congruence, the transfer price that ANZ Ltd. would charge AUS Ltd. would be the variable cost of ₹8 per unit and ₹20,000 towards lost contribution as explained above. Therefore, the transfer price

$$\begin{aligned} &= (\text{₹8 per unit} \times 4,000 \text{ components}) + \text{₹20,000} \\ &= \text{₹32,000} + \text{₹20,000} \\ &= \text{₹52,000 for 4,000 components} \end{aligned}$$

Therefore, per component, the price charged would be ₹52,000 / 4,000 = ₹13 per component. This is lower than the external market price of ₹15 per unit. Therefore, in the interest of goal congruence the cheaper option is preferred. AUS Ltd. should source its components from ANZ Ltd, for a total procurement cost of ₹52,000.

3. Skilled labour is in short supply and can only be obtained by reducing the production of product 'G', resulting in a loss of contribution of ₹24 (given) or ₹6 per hour of skilled labour. Hence the relevant labour cost will be ₹6 (contribution lost per hour) + ₹5 (hourly rate of skilled labour) i.e. ₹11 per hour.
4. AUS Ltd. has a number of options: (a) If the machine were to be hired it would have a cost of ₹15,000; (b) if the machine were bought and then sold at the end of the work it would have a net cost of ₹20,000; or (c) if the machine were bought and then modified to avoid the need to buy the other machine it would have a net cost of ₹10,000 (₹50,000 plus ₹5,000 modifications less ₹45,000 cost of another machine). Thus, the most economic approach is buy the machine and then modify it so the relevant cost is ₹10,000.
5. The machine operating costs are future costs of doing the work and therefore are relevant.
6. The supervisor's salary is irrelevant, but the bonus needs to be included because it is dependent on this work and therefore is relevant.
7. The development time has already been incurred. Therefore, it is a past cost and not relevant.
8. General fixed overhead costs and their absorption are not relevant because they will be incurred whether the work goes ahead or not. Depreciation is also not relevant because it is an accounting entry based on the historical purchase of assets. It is not affected by the work being considered.

- (ii) Two main issues arise when pricing work based on relevant costs:
- Profit reporting; and
 - Pricing of future work.

With regard to profit reporting, the decision as to whether to proceed with the work will have been based on the use of relevant costs, but the routine reporting of the profit from the work will be based on the company's normal accounting system. Since this system will be based on total cost, it is probable that the costs of the work reported will be greater than its relevant cost. Consequently, the amount of profit reported to have been made on this order will be lower than expected and may even be a loss. This may cause difficulties for the manager who accepted the work as an explanation will be required of the reasons why there is such a difference in profit.

With regard to the pricing of future work the difficulty lies in increasing the price for similar items for the same customer in future. Once a price is set, customers tend to expect that any future items will be priced similarly. However, where a special price has been offered based on relevant cost because of the existence of spare capacity the supplier would not be able to continue to price on that basis as it does not recover its long term total costs. There may also be difficulties created by this method of pricing as other customers are being charged on a full cost basis and if they were to discover that a lower price was offered to a new customer they would feel that their loyalty was being penalised.

(iii) **Prevention**

Operations: Preventative maintenance and checking of the calibration of machinery. This would reduce the number of potentially faulty products being produced and therefore reduce guarantee claims.

Appraisal

Inbound Logistics: Reduce costs of incoming inspections by building close links with suppliers and getting them to adopt TQM. If suppliers can guarantee their quality, the n inbound inspections could be eliminated.

Internal Failure

Operations: Reduce costs of re-works by training employees on a continual basis e.g. quality circles. This would reduce failure costs and also improve quality.

External Failure

Service: Design quality into the product to try to prevent guarantee claims and therefore the cost of servicing/repairing the product.



PRICING DECISION



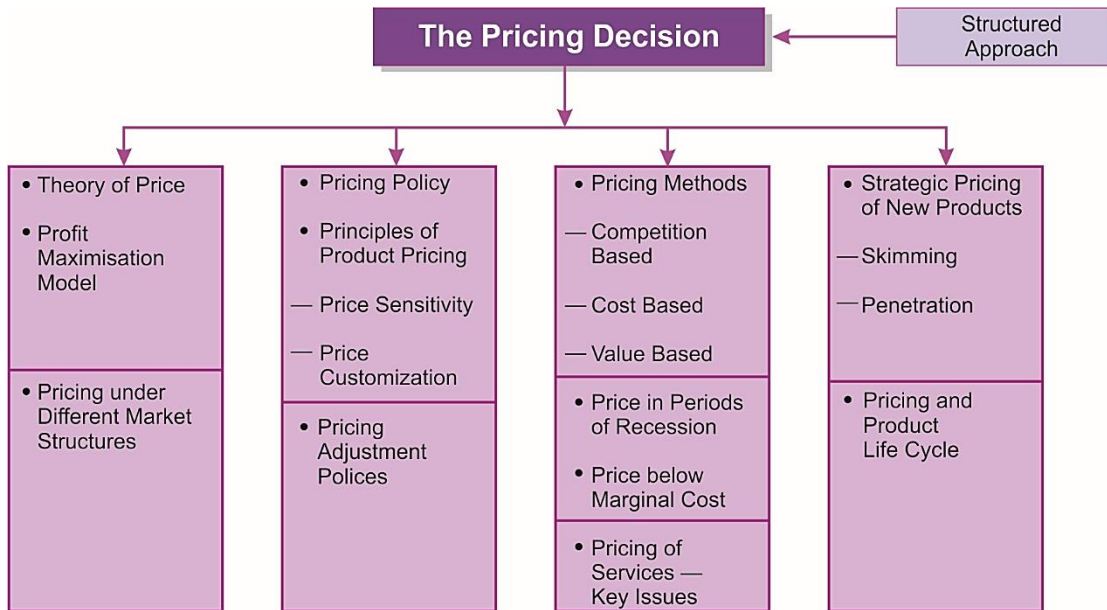
LEARNING OUTCOMES

After studying this chapter, you will be able to:

- ❑ **Discuss Pricing** Strategies and their consequences.
- ❑ **Calculate** the optimum selling price and quantity, equating marginal cost and marginal revenue
- ❑ **Determine** prices and output levels for profit maximization using the demand based approach to pricing.
- ❑ **Explain** different price strategies
- ❑ **Calculate** a price from a given strategy using cost-plus and relevant cost.



CHAPTER OVERVIEW



PRICING DECISION

“A pricing decision is one of the most crucial & difficult decision that a firm has to make. Such a decision affects the long- term survival of any profit oriented enterprise.”

Accounting information is often an important input to pricing decisions. Most firms need to make decision about setting or accepting selling prices for their products or services. In some firms selling price is derived directly from cost information by estimating future product’s cost & adding a suitable profit margin. In others, an established market price is accepted.

Generally, pricing decisions are influenced by the pricing policy followed by an organisation. Pricing policies are made taking overall objectives of an organisation into account. Thus, before fixing price of a product, objectives of the organisation must be understood first to achieve the organisation’s goal. Objective of an organisation may be either to maximise the profit or maximise the sales or maximise the output or optimal utilisation of resources etc.

In this chapter, we will learn pricing principles, pricing policies and pricing strategies.



THEORY OF PRICE

The basic approach in most of the micro-economic theory (theory of the individual firm and its relation to other firms) defines the term optimum price as that price which yields the maximum profits (excess of total revenues over total costs).

Thus, the basic assumption of the pricing theory is that the firm's main objective is to maximise its profits. It also assumes that the firm takes into consideration the position of demand and cost functions and that the firm produces one product.

If a firm sells unlimited number of units, the total revenue line will be a straight line arrived at by $TR = mx$.

Where,

TR = Total revenue line

m = quantity of units sold

x = price per unit.

In most of the market situations, however, additional units can be sold by reducing the price. This means that although the total sales revenue will increase as more and more units are sold, the increase in total revenue will decline gradually as sales increases. Consider the following example:

Example

A firm's pricing of a product is as under:

20 units @ ₹4.00 per unit.

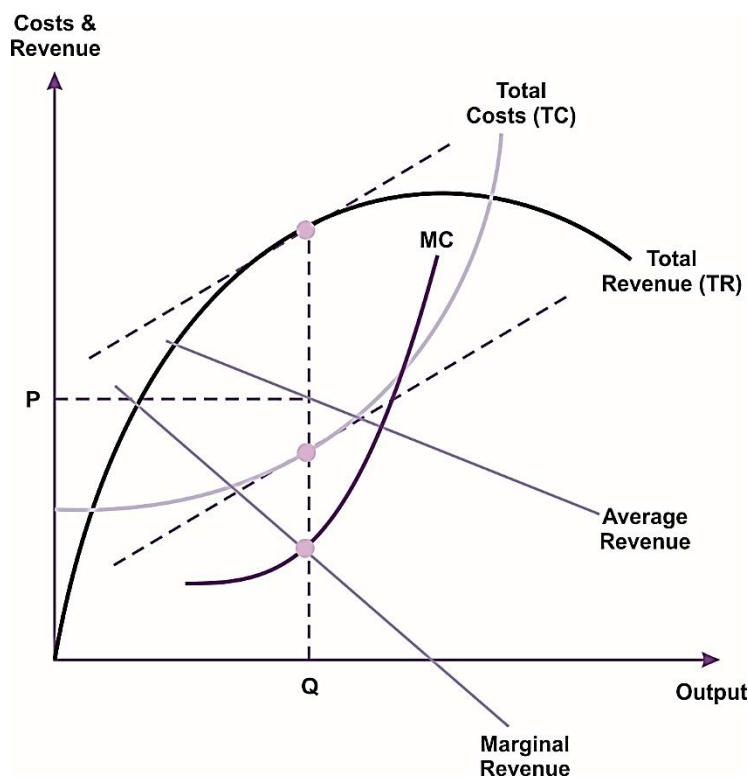
21 units @ ₹3.90 per unit.

22 units @ ₹3.80 per unit.

The sales figures can be summarised as under:

Quantity	Price (₹)	Total Sales Revenue (₹)	Addition to Total Revenue (₹)
20	4.00	80.00	—
21	3.90	81.90	1.90
22	3.80	83.60	1.70

The reduction in the price of each additional unit reflects a gradual reduction in the steepness of the total revenue curve as shown in the figure. The total cost curve will however, register an increase in the steepness because as the volume increases, the cost also increases because of the difficulty of expanding output with a given productive resources.



At point Q, the gap between the total cost line and total revenue is the maximum, thus Q is the point of optimum volume. Any attempt to increase the volume beyond this point will reduce the profit because the incremental cost will be more than the incremental revenue.

These relations are expressed in terms of marginal revenue and marginal cost. Marginal revenue is the increase in total revenue that results from the sale of one additional unit. In the example given above, the marginal revenue of increasing one unit from 20 units to 21 units is ₹1.90. Marginal cost is the increase in total cost that results from the production of one additional unit.



PROFIT MAXIMIZATION MODEL

Pricing model is a mathematical model which uses economic theory of pricing.

- (i) As per economic theory of pricing, Profit is Maximum at a *level of output* where Marginal Revenue (MR) is equal to Marginal Cost (MC) i.e.

$$\text{Marginal Revenue (MR)} = \text{Marginal Cost (MC)}$$

This model determines the level of production up to which production can be continued.

- (ii) The Basic Price equation, which is used to determine the Price where Profit is Maximum. The equation is written as:

$$P = a - bQ$$

Where, P = Price

b = Slope of the Demand Curve, Calculated as $b = \frac{\text{Change in Price}}{\text{Change in Quantity}}$

Q = Quantity Demanded

a = Price at Which Demand is Zero

(iii) The Marginal Revenue equation is written as

$$\text{Marginal Revenue (MR)} = P = a - 2bQ$$

Example

Aditya Heavy Engineering Ltd. (AHEL) produces its only product A₇. To manufacture a unit of A₇, variable cost of ₹2,20,000 is incurred. Market research has indicated that at a selling price of ₹ 5,10,000 no order will be received, but the demand for A₇ will be increased by two units with every ₹5,000 reduction in the unit selling price below ₹5,10,000.

To determine the unit selling price for A₇ that will maximize the profit of AHEL. We assume that:

Selling Price per unit of A₇ is 'P', and Quantity Demanded is 'Q'

The Marginal Cost of a unit of A₇ is ₹2,20,000

Price Equation for 'A₇'

$$P = a - bQ$$

$$P = 5,10,000 - (5,000 / 2) \times Q$$

$$\text{Revenue (R)} = Q \times [5,10,000 - 2,500 \times Q]$$

$$= 5,10,000 Q - 2,500 Q^2$$

$$\text{Marginal Revenue (MR)} = a - 2bQ$$

$$= 5,10,000 - 2 \times (5,000 / 2) \times Q$$

$$= 5,10,000 - 5,000 Q$$

$$\text{Marginal Cost (MC)} = 2,20,000$$

Profit is Maximum where Marginal Revenue (MR) equals to Marginal Cost (MC)

$$5,10,000 - 5,000 Q = 2,20,000$$

$$Q = 58 \text{ units}$$

By Putting the Value of 'Q' in Price Equation, Value of 'P' is Obtained

$$P = 5,10,000 - (5,000 / 2) \times Q$$

$$= 5,10,000 - 2,500 \times 58 \text{ units}$$

$$= 3,65,000$$

At Selling Price of ₹3,65,000 AHEL's Profit will be Maximum.



PRICING UNDER DIFFERENT MARKET STRUCTURES

The determination of optimal price can be considered under the following market structures:

Perfect Competition

Under perfect competitive market, there are **large numbers of sellers** selling a **homogeneous product** using identical production process and all of them **have perfect information** about the market and price. Perfect market allows **free entry and exit** of firms into and out of the industry.

Under this type of market, firm has no pricing policy of its own as the **sellers are price takers** (i.e. it has to accept the price determined by the market) and sell as much as they are capable of selling at the prevailing market price. Since each firm produces and sells a homogeneous product, it cannot increase its price beyond the market price. If it does so then it has to lose all of its market demand to the competitors.

There is no control over market price which will equate the quantities available with the quantities which the buyers are willing to buy. The firm has to take a decision in favour of the quantity to sell. The firm can continue to produce so long as its marginal cost is less than or equal to its selling price, upto the point at which the marginal cost is equal to price, increase in output will add to revenue and thereafter the increase will add to cost. It can be seen in following example.

Example

Aditya LLP produces a product X, the market for the product X is competitive and the prevailing market price for a unit of product X is ₹40. The following table presents the marginal cost and profit for the product X:

Units	Total Revenue (₹)	Total Cost (₹)	Marginal Cost (₹)	Profit (₹)
0	0	20	-	(20)
1	40	30	10	10
2	80	50	20	30
3	120	85	35	35
4	160	125	40	35
5	200	170	45	30
6	240	217	47	23

The marginal cost for producing 4th unit is equal to the price per unit. Thus, Aditya LLP can maximize its profit at 4th unit level.

Monopoly

Monopoly is a market condition where there is only **one supplier** or producer of a **homogeneous product** for which there is **no close substitute** but has **many buyers**. Under the monopoly, **a firm is a price setter** i.e. it can fix any price but here also the pricing is done taking elasticity of demand for the product into consideration. That means though the seller/ producer can fix any

price but it will go for the price where demand for the product and consequent profit will be maximum.

Monopolistic Competition

The monopolistically competitive market is one in which there are **large number of firms producing similar but not identical products**. Since there is limit to the growth of competitors the excess profits earned by monopolistic situation attracts new competition. This will have a long-run effect on the excess profits which will tend to diminish because of the price competition with close substitutes. The company will, however, have to compare marginal cost and marginal revenue in maximising its profits.

Under monopolistic condition, consumers may buy more at a lower price than at higher price. The profit can be maximised by equating marginal revenue with marginal cost.

Oligopoly

A market structure where there are **few firms** producing or selling **homogenous or identical product**. In this type of market structure the firms are aware of the mutual interdependence of investment, production process, advertising and sales plan of its rival firm. Hence, any change in any variable by a firm is likely to have an equal reaction on the part of other competing firms. It is therefore, clear that the oligopolistic firm, *while determining the price for its product, consider not only the demand for the product but also the reactions of the other firms in the industry to any action or decision it may take.*

If a firm does not follow or adapt its pricing policy in consonance with its competitor, the shift in the sales will be sensitive. That means demand will shift towards the lower price. Thus, each firm will study the potential reaction before increasing or decreasing the selling price. The firms in oligopolistic market maintain the price of the product either by close analysis of each other's behavior or by means of cooperation and collusion.

Pricing Strategies of Oligopolies

Oligopolies may pursue the following pricing strategies:

- Predatory Pricing: Keeping price artificially low, and often below the full cost of production.
- They may also operate a Limit-Pricing Strategy to discourage entrants, which is also called entry forestalling price.
- Oligopolists may collude with rivals and raise price together, but this may attract new entrants.
- Cost-Plus Pricing: A straightforward pricing method, where a firm sets a price by calculating average production costs and then adding a fixed mark-up to achieve a desired profit level. There are different versions of cost-plus pricing, including full cost pricing, where all costs - that is, fixed and variable costs - are calculated, plus a mark-up for profits, and contribution pricing, where only variable costs are calculated with precision and the mark-up is a contribution to both fixed costs and profits.

Non-Price Strategies

Non-price competition is the favoured strategy for oligopolists because price competition can lead to destructive price wars – examples include:

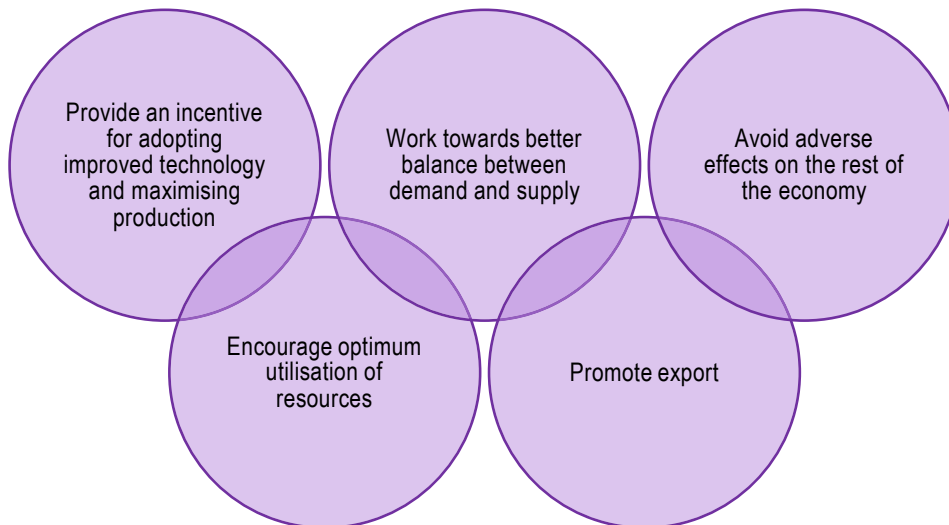
- Trying to improve Quality & After Sales Servicing, such as offering extended guarantees.
- Spending on Advertising, Sponsorship, and Product Placement.
- Sales Promotion, such as buy-one-get-one-free, is associated with the large supermarkets, which is a highly oligopolistic market, dominated by three or four large chains.
- Loyalty Schemes, which are common in the supermarket sector, such as Reliance's *One Card*.



PRICING POLICY

The pricing policy plays an important role in a business because the long run survival of a business depends upon the firm's ability to increase its sales and derive the maximum profit from the existing and new capital investment. Although cost is an important aspect of pricing, consumer demand and competitive environment are frequently far more significant in pricing decisions. These are also known as determinants of pricing or market powers. Thus, costs alone do not determine price. Cost is only one of the many complex factors which determine prices. There must however, be some margin in prices over total cost if capital is to be unimpaired and production maximised by the utilisation of internal surplus.

The pricing policy and the relative price structure should:



 **PRINCIPLES OF PRODUCT PRICING**

As already stated, cost should not be considered as an important determinant of price. The tendency should be to lower the price in such a way so as to choose a right combination of price and output to maximise profits. The important determinants of price, therefore, are competitive situations prevailing in the market and elasticities.

Taking the standard products into consideration, the pricing principles are much the same whether the product is a new one or the one already well established in the market. However, the environmental situation and information base are different.

To arrive at a right price, the following important points to be kept in the mind:

Price Customization

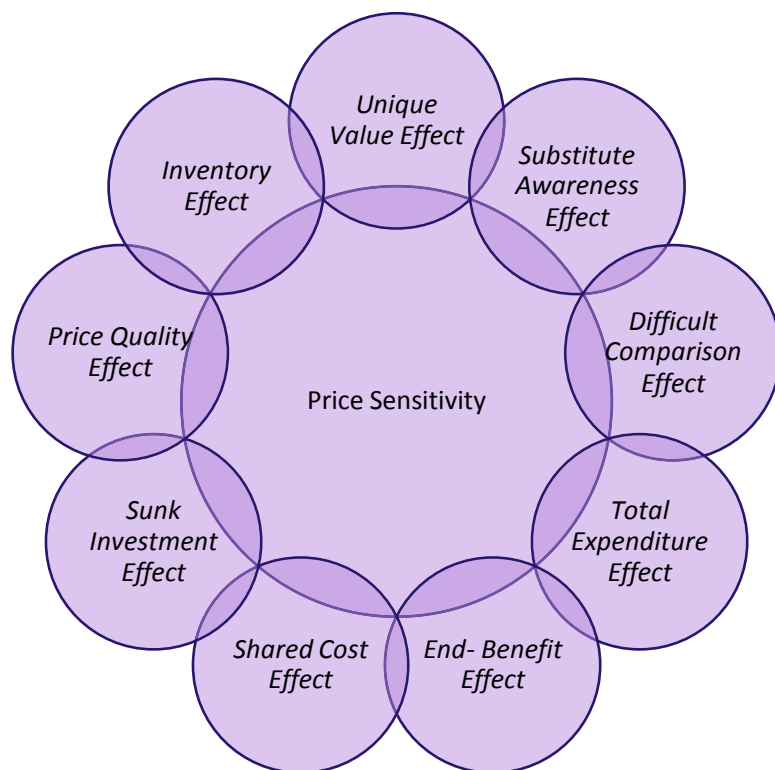
Pricing of a product is some time customised keeping taste, preference and perceived value of a consumer into consideration. Price customisation is done in various ways:

- *Based on product line:* Based on the requirement of the consumer products can be customized and accordingly the prices. For example, some may like to have a smartphone with 16 GB over 32 GB. In this case pricing for the product can be based on memory specification.
- *Based on customer's past behaviour:* A customer with good payment record may be given more discounts than the others.
- *Based on demographics:* Different pricing may be adopted based on age or social status. For example, railway fare concession for senior citizen and concessional price tickets for military personnel.
- *Based on time differential:* Pricing for a product or service is also done on the basis of time differential i.e. different price for different time period. For example, discounted price for data usage provided by a broadband service provider if subscription paid for six months at a time.

Apart from above pricing principles, other macro economic and legal factors should also be given due importance while chalking out a pricing strategies.

Price Sensitivity

It measures the customer's behaviour to the change in price of a product. Nagle¹ has identified nine factors that contribute to price sensitivity. These factors are:



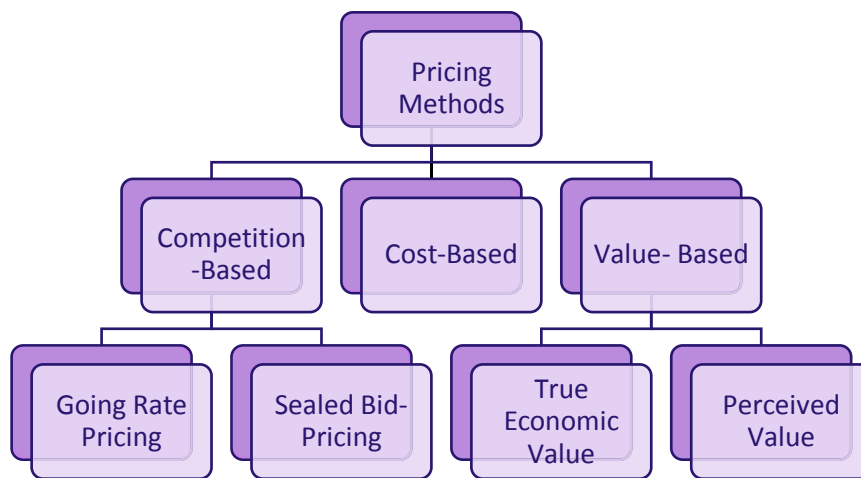
- *Unique Value Effect*- More unique the product, lower is the price sensitivity.
- *Substitute Awareness Effect*- If the buyers are aware of substitutes and these perform the same function, then the buyer's price sensitivity will be high.
- *Difficult Comparison Effect*- Price sensitivity will be low if the buyer has difficulty comparing two alternatives.
- *Total Expenditure Effect*- If then expenditure on the product represents a low proportion of the consumer income, the price sensitivity will be less visible for such a product.
- *End- Benefit Effect*- Buyers are less price sensitive where the expenditure on the product is low compared to the total cost of the end product.
- *Shared Cost Effect*- If the cost of the product is shared by another party, the buyer will have less prone to price sensitivity.
- *Sunk Investment Effect*- Price sensitivity is low in products which are used along with assets previously bought.
- *Price Quality Effect*- Higher the perceived quality of the product, lower the price sensitivity.
- *Inventory Effect*- If the product cannot be stored, the buyer will be less price sensitive.

(1- Source: *The Strategy and Tactics of Pricing*, Thomas Nagle)

One of the methods more commonly used for measuring price sensitivity is **controlled experimentation**. In this method, customers are offered different brands at different prices and customer's responses are obtained. Then the company's brand prices are changed and customer's response at each price level is recorded. The price at which demand for the product starts declining is the level where price sensitivity begins and based on the response level, sensitivity can be measured. It depends on the nature of the product and buyer characteristics.

PRICING METHODS

Costs, Demand, and Competition define different pricing methods that a firm may adopt. Let us understand these methods:



Cost-Based Pricing Method

In many businesses, the common method of price determining is to estimate the *cost of product & fix a margin of profit*. The term 'cost' here means **Full Cost** at current output and wages level since these are regarded as most relevant in price determination. If a firm wants to survive and stay in business, it has to maintain its fixed capital intact so that its fixed assets may be replaced at the end of their useful working life out of the funds generated from profits retained in the business. In a period of relatively stable price levels, depreciation based on historical cost of fixed assets would perhaps be adequate for achieving this object. In periods when the price level is continuously changing, the firm may not be left with adequate funds generated out of accumulated depreciation at the end of the life of the plant to replace the plant at a higher price. Hence depreciation should be properly included as a part of cost so as to leave sufficient profits for asset replacement.

Pricing based on total costs is subjected to two limitations. They are:

- The allocation of inter-departmental overheads is based on an *arbitrary basis*; and
- The allocation overheads will require estimation of normal output which often cannot be done precisely.

In order to avoid these complications, **Variable Costs** which are considered as relevant costs are used for pricing, by *adding a markup* (to include fixed costs allocation also).

Sometimes, instead of arbitrarily adding a percentage on cost for profit, the firm determines an *average mark-up* on cost necessary to produce a **desired Rate of Return on Investment**. The rate of return to be earned by the firm or industry must depend on the *risk involved*.

Illustration

Bosch Ltd. has developed a special product. Details are as follows: The product will have a life cycle of 5,000 units. It is estimated that market can absorb first 4,500 units at ₹ 64 per unit and then the product will enter the "decline" stage of its life cycle.

The company estimates the following cost structure:

Direct Labour..... ₹ 6 per hour

Other variable costs..... ₹ 19 per unit

Fixed costs will be ₹ 40,000 over the life cycle of the product. The 'labour rate' and both of these costs will not change throughout the product's life cycle.

The first batch of 100 units will take 1,000 labour hours to produce. There will be an 80% learning curve that will continue until 2,500 units have been produced. Batches after this level will each take the same amount of time as the 25th batch. The batch size will always be 100 units.

Required

CALCULATE average selling price of the final 500 units that will allow the company to earn a total profit of ₹ 80,000 from the product if average time for 24 batches is 359.40 hours.

(Note: Learning coefficient is -0.322 for learning rate of 80%).

The values of Logs have been given for calculation purpose:

*$\log 2 = 0.30103$; $\log 3 = 0.47712$; $\log 5 = 0.69897$; *antilog of 2.534678 = 342.51; antilog of 2.549863 = 354.70; antilog of 2.555572 = 359.40; antilog of 2.567698 = 369.57**

Solution

Average 'Selling Price' of the final 500 units

Particulars	Amount (₹)
Direct Labour [(8,867.50 hrs. + 241.90 hrs. × 25 batches) × ₹ 6]	89,490
Add: Other Variable Costs (5,000 units × ₹ 19)	95,000
Add: Fixed Costs	40,000
Total Life Cycle Cost	2,24,490
Add: Desired Profit	80,000
Expected Sales Value (5,000 units × ₹ 19)	3,04,490
Less: Sales Value (4,500 units × ₹ 64)	2,88,000

Sales Value (Decline Stage)	...(A)	16,490
Sales Units (Decline Stage)	...(B)	500
Average Sales Price <i>per unit</i>	...(A)/ (B)	32.98

Workings

(i) The cumulative average time *per batch* for the first 25 batches

The usual learning curve model is

$$y = ax^b$$

Where

y = Average time per batch (hours) for x batches

a = Time required for first batch (hours)

x = Cumulative number of batches produced

b = Learning coefficient

The Cumulative Average Time *per batch* for the first 25 batches

$$y = 1,000 \times (25)^{-0.322}$$

$$\log y = \log 1,000 - 0.322 \times \log 25$$

$$\log y = \log 1,000 - 0.322 \times \log (5 \times 5)$$

$$\log y = \log 1,000 - 0.322 \times [2 \times \log 5]$$

$$\log y = 3 - 0.322 \times [2 \times 0.69897]$$

$$\log y = 2.549863$$

$$y = \text{antilog of } 2.549863$$

$$y = 354.70 \text{ hours}$$

(ii) The time taken for the 25th batch

$$\begin{aligned} \text{Total Time for first 25 batches} &= 354.70 \text{ hours} \times 25 \text{ batches} \\ &= 8,867.50 \text{ hours} \end{aligned}$$

$$\begin{aligned} \text{Total Time for first 24 batches} &= 359.40 \text{ hours} \times 24 \text{ batches} \\ &= 8,625.60 \text{ hours} \end{aligned}$$

$$\begin{aligned} \text{Time taken for 25th batch} &= 8,867.50 \text{ hours} - 8,625.60 \text{ hours} \\ &= 241.90 \text{ hours} \end{aligned}$$

Competition-Based Pricing Method

When a company sets its price mainly on the consideration of *what its competitors are charging*, its pricing policy under such a situation is called competitive pricing or competition-oriented pricing. It is not necessary under competitive pricing to charge the same price as charged by the concern's competitors. But under such a pricing the concern may keep its prices lower or higher than its competitors by a certain percentage. Its *own costs or demand may change*, but the concern maintains its price because its competitors maintain their prices. Conversely, the concern will change its price when its competitors change their price, even if its own costs or demand have not altered. Different types of competitive pricing in vogue are as follows:

Going Rate Pricing

It is a competitive pricing method under which a firm tries to *keep its price at the average level charged by the industry*. The use of such a practice of pricing is especially *useful where it is difficult to measure costs*. Adoption of going rate pricing will not only yield fair return but would be least disruptive for industry's harmony.

Going rate pricing primarily characterises pricing practice in *homogeneous product* markets. The concern selling a homogeneous product in a highly competitive market has actually very little choice about the setting of its price. There is apt to be a market determined price for the product, which is not established by any single firm or clique of firms but through the collective interaction of buyers and sellers. The concern which is going to charge more than the going rate would attract virtually no customers. The concern should not charge less because it can dispose of its entire output at the going rate.

Thus, under highly competitive conditions in a homogeneous product market (such as food, raw materials and textiles) the concern really has no pricing decision to make. The major challenge before such a concern is *good cost control*. Since promotion and personnel selling are not in the picture, the major marketing costs arise in physical distribution.

In pure oligopoly, where a few large concerns dominate the industry, the concern also tends to charge the same price as is being charged by its competitors. Since there are only a few concerns, each firm is quite aware of other's prices, and so are the buyers.

This does not mean that the going price in an oligopoly market will be in practice indefinitely. It cannot, since industry costs and demand change over time.

Sealed Bid-Pricing

Competitive pricing also dominates in those situations where firms compete on the basis of bids, such as original equipment manufacturer and defense contract work. The bid is the firm's offer price, and it is a prime example of *pricing based on expectations of how competitors will price rather than on a rigid relation based on the concern's own costs or demand*. The objective of the firm in the bidding situation is to get the contract, and this means that it hopes to set its price lower than that set by any of the other bidding firms. But however, the firm does not ordinarily set its price below a certain level. Even when it is anxious to get a contract in order to keep the plant

busy, it cannot quote price below marginal cost. On the other hand, if it raises its price above marginal cost, it increases its potential profit but reduces its chance of getting the contract.

Value- Based Pricing Method

There is an increasing trend to price the product on the basis of *customer's perception of its value*. This method helps the firm in reducing the threat of price wars. Marketing research is important for this method. It is based on:

Objective Value or True Economic Value (TEV)

This is a measure of benefits that a product is *intended to deliver to the consumers relative to the other products* without giving any regard whether the consumer can recognize these benefits or not.

True economic value for a consumer is calculated taking two differentials into consideration:

$$\text{TEV} = \text{Cost of the Next Best Alternative} + \text{Value of Performance Differential}$$

Cost of the next best alternative is the cost of a comparable product offered by some other company. Value of performance differential is the value of additional features provided by the seller of a product.

A firm's product may be superior to the next best alternative in some dimensions but inferior in others.

Example

A customer wants to buy a System for a single year (after which it will be scrapped) with plans to use it for 2,500 hrs.

Cost Structure (similar products):

Particulars	System-X	System-X ²
Operating Cost/ hour	₹ 5	₹ 7.50
Probability of System Crash	10%	0.5%
Price	₹ 37,500	?

Find the TEV for the System-X² if the cost of a System Crash to the buyer is ₹1,00,000.

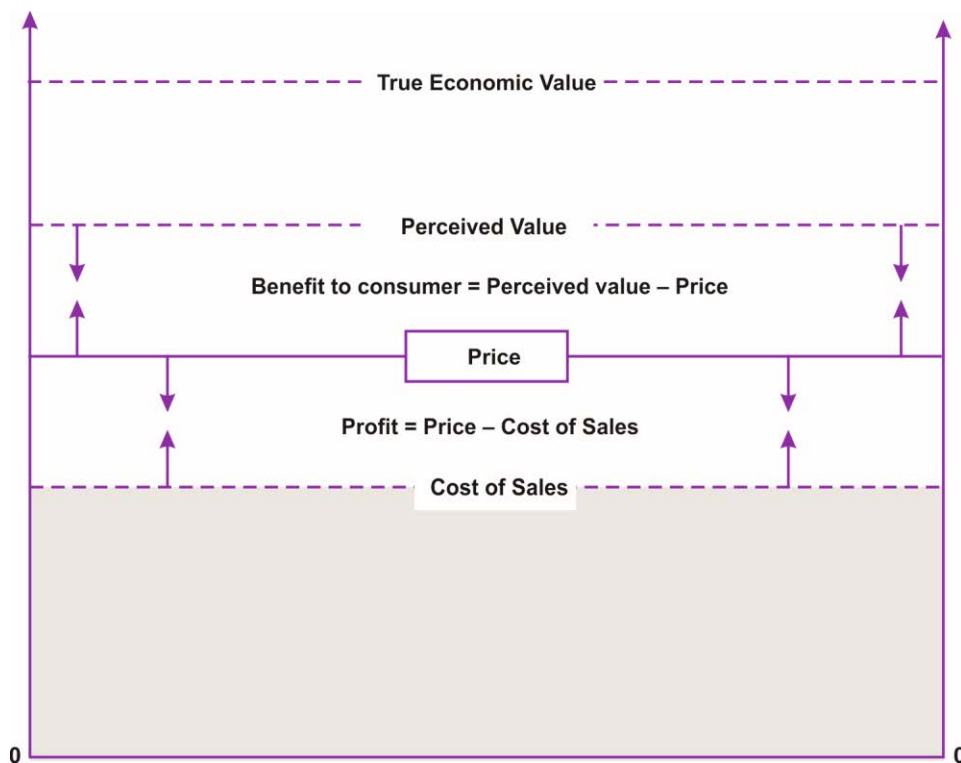
TEV=

Particulars	₹
Operating Cost	- ₹6,250 2,500 hrs. × (₹5.00 - ₹7.50)
System Crash Savings	₹9,500 ₹1,00,000 × (10.00% - 0.50%)
Price of Next Best Alternative	₹37,500
TEV	₹40,750

Perceived Value

This is the *value that consumer understands the product deliver to it*. It is the price of a product that a consumer is willing to spend to have that product.

At the time of fixing price, it is to be kept in the mind that any price which set below the perceived value but above the cost of goods sold give incentives to both buyers and the seller. This can be understood with the help the diagram given below.



Creating value for the customers is one of the important objectives of a firm. A firm makes all the efforts to create value and to achieve this it formulates its marketing strategy in that direction. Understanding customers' wants and needs is foundation for building this value. To create value, a firm makes the following **marketing strategies**:

- First it develops a product that satisfy the wants and needs of the customers,
- After identification and development, it designs a promotion program to convey the value of the products to the customers.
- It chooses the right distribution channel through which its product will reach to the customers
- At last it has to design a pricing strategy that creates incentive to purchaser to buy the product and to seller to sell the product.

PRICING IN PERIODS OF RECESSION

In periods of recession, a firm may sell its articles at a **price less than the total cost but above the marginal cost** for a limited period.

The advantages of this practice are:

- The firm can continue to produce and use the services of skilled employees who are well trained and will be difficult to re-employ later if discharged.
- Plant and machinery can be prevented from deterioration through idleness.
- The business would be ready to take advantage of improved business conditions later.
- This avoids the competition of securing the business of the firm.

One thing to remember here is that a situation like this should not lead to a drastic price cutting and the orders accepted should not cover a long period extending over the production facilities of a period when business conditions improve.

PRICING BELOW MARGINAL COST

Firm may also be justifiable to sell the product at a **price below marginal cost** for a limited period provided the following conditions prevail:

- Where materials are of perishable nature.
- Where stocks have been accumulated in large quantities and the market prices have fallen. This will save the carrying cost of stocks.
- To popularize a new product.
- Where such reduction enables the firm to boost the sales of other products having larger profit margin.

STRATEGIC PRICING OF NEW PRODUCTS

The pricing of new product poses a bigger problem because of the uncertainty involved in the estimation of their demand. In order to overcome this difficulty experimental sales are conducted in different markets using different prices to see which price is suitable. A company may, for example, choose three different markets and by using the same amount of sales promotional activities, ascertain what the right price is. In such circumstances, it may even prove that the highest price yielding the largest unit contributory margin need not necessarily maximise the profits. A lower price may well go to maximise the profits. But at the same time if a product is priced very low to attract more demand, it may be difficult in the future to raise the price as it may not be acceptable to the consumers. So, pricing of a new product is very critical issue which should be decided after a thorough market study and consumer behavior analysis.

A new product is analysed into three categories for the purpose of pricing:

Revolutionary Product: A product is said to be revolutionary when it is new for the market and has the potential to create its own value. This type of product has revolutionary impact on the market and consumer behaviour. It replaces the existing method or technology and the approach to doing a work is quite different and unique. These products enjoy the benefit of product differentials and have the potential of being market leader.

Revolutionary product may enjoy the premium price as a reward for its innovation and taking first initiative.

Evolutionary Product: A product introduces upgraded version with few additional characteristics of the product is known as evolutionary product.

The evolutionary products may be priced taking cost-benefit, competitor, and demand for the product into account.

Me-too Product: A product is said to be me-too product when its emergence is a result of the success of a revolutionary product. These types of products are very similar (in ordinary language imitation) to revolutionary and/ or evolutionary products of other firms. The firm while producing me-too products, generally follows the similar production process and technology that is used by the other firms. These are known as market followers.

The me-too products are price takers as the price is determined by the market mainly by the competitive forces.



(Source: *The Price Advantage* By Michael V. Marr, Eric V. Roegner, Craig C. Zawada)

Independent Situations

Sl.	Situation	RP/EP/MP	Pricing
I	II	III	IV
(i)	Adjustable work table like a stool, has been successfully capturing the market. Company X makes a small variant of this product and is trying to enter the market.	Me-too Product (MP)	Market Price that is determined by competitive forces for the successful product.
(ii)	R & D has just been completed on an innovative computer processor in the shape of a pen, with accompanying pen-like devices to act as keyboard projector and monitor projector. This is expected to get the laptops out of business due to extreme ease of portability of just 3 pen-like light weight devices.	Revolutionary Product (RP)	Premium Pricing , it can expect to make a tidy profit as a reward for innovation and taking its first initiative.
(iii)	A successful mobile manufacturing company has built into its latest mobile phone, an additional sliding screen and improved its processor capabilities so that the phone is almost a laptop.	Evolutionary Product (EP)	Demand Based Pricing , Price higher than the earlier version to justify its Costs and Benefits subject to what amount can be stepped up in the market.

While preparing to enter the market with a new product, management must decide whether to adopt a skimming or penetration pricing strategy.

Skimming Pricing

It is a policy of high prices during the early period of a product's existence. This can be synchronised with high promotional expenditure and in the later years the prices can be gradually reduced. The reasons for following such a policy are :

- (i) The demand is likely to be inelastic in the earlier stages till the product is established in the market.
- (ii) The change of high price in the initial periods serves to skim the cream of the market that is relatively insensitive to price. The gradual reduction in price in the later year will tend to increase the sales.
- (iii) This method is preferred in the beginning because in the initial periods when the demand for the product is not known the price covers the initial cost of production.
- (iv) High initial capital outlays, needed for manufacture, results in high cost of production. Added to this, the manufacturer has to incur huge promotional activities resulting in increased costs. High initial prices will be able to finance the cost of production particularly when uncertainties block the usual sources of capital.

Penetration Pricing

This policy is in favour of using a low price as the principal instrument for penetrating mass markets early. It is opposite to skimming price. The low price policy is introduced for the sake of long-term survival and profitability and hence it has to receive careful consideration before implementation. It needs an analysis of the scope for market expansion and hence considerable amount of research and forecasting are necessary before determining the price.

Penetrating pricing, means a pricing suitable for penetrating mass market as quickly as possible through lower price offers. This method is also used for pricing a new product. In order to popularise a new product penetrating pricing policy is used initially. The company may not earn profit by resorting to this policy during the initial stage. Later on, the price may be increased as and when the demand picks up. Penetrating pricing policy can also be adopted at any stage of the product life cycle for products whose market is approached with low initial price. The use of this policy by the existing concerns will discourage the new concerns to enter the market.

We must distinguish penetration pricing from *Predatory Pricing*. Predatory Pricing (loss leading) is the practice of selling a product or service at a very low price, intending to drive competitors out of the market or create barriers to entry for potential new competitors.

The three circumstances in which penetrating pricing policy can be adopted are as under:

- (i) When demand of the product is elastic to price. In other words, the demand of the product increases when price is low.
- (ii) When there are substantial savings on large scale production. Here increase in demand is sustained by the adoption of low pricing policy.
- (iii) When there is threat of competition. The prices fixed at a low level act as an entry barrier to the prospective competitors.

Independent Situations

Situation		Appropriate Pricing Policy
(i)	'A' is a new product for the company and the market and meant for large scale production and long term survival in the market. Demand is expected to be elastic.	Penetration Pricing
(ii)	'B' is a new product for the company, but not for the market. B's success is crucial for the company's survival in the long term.	Market Price or Price Just Below Market Price
(iii)	'C' is a new product to the company and the market. It has an inelastic market. There needs to be an assured profit to cover high initial costs and the unusual sources of capital have uncertainties blocking them.	Skimming Pricing
(iv)	'D' is a perishable item, with more than 80% of its shelf life over.	Any Cash Realizable Value*

(*) this amount decreases every passing day.

Concept in Practice

Samsung Smartphones

Samsung has reached unbelievable heights with its smartphones, which helped the brand to become a symbol of quality and reliability for its consumers. Smartphones of Samsung are leading the market with Apple's iPhone. As Apple, Samsung also uses *skimming price* to gain the upper hand over their competitors. For instance, Galaxy S6 and S6 Edge were the brands new products of Samsung claiming that they were the most beautiful smartphones ever created. S6 Edge (64 GB) that costs 1 180\$ smoothly sold around the globe.

(Source: <http://inevitablesteps.com/marketing/samsung-marketing-strategy/>)



PRICING AND PRODUCT LIFE CYCLE

Introduction Stage	Growth Stage	Maturity Stage	Decline Stage
<ul style="list-style-type: none"> ▪ <i>Skimming Policy</i> with high prices, but low profit margin due to high fixed costs. 	<ul style="list-style-type: none"> ▪ Reduce price to penetrate market further. 	<ul style="list-style-type: none"> ▪ Price to match or beat competitor. 	<ul style="list-style-type: none"> ▪ Cut price if not repositioning.
<ul style="list-style-type: none"> ▪ <i>Penetration Policy</i> to enter the market and gain a high share quickly or to prevent competitors from entering 		<ul style="list-style-type: none"> ▪ Retain higher prices in some market segments. 	<ul style="list-style-type: none"> ▪ Some increases in prices may occur in the late decline stage.

(Source: *Marketing Fundamentals 2007-2008* By Geoff Lancaster, Frank Withey)

Case Scenario

Netcom Ltd. manufactures and sells a number of products. All of its products have a life cycle of less than one year. Netcom Ltd. uses a four stage life cycle model (Introduction, Growth, Maturity and Decline).

Netcom Ltd. has recently developed an innovative product. It was decided that it would be appropriate to adopt a market skimming pricing policy for the launch of the product.

However, Netcom Ltd. expects that other companies will try to join the market very soon.

This product is currently in the Introduction stage of its life cycle and is generating significant unit profits. However, there are concerns that these current unit profits will not continue during the other stages of the product's life cycle.

Required

EXPLAIN, with reasons, the changes, if any, to the unit selling price and the unit production cost that could occur when the products move from the previous stage into each of the following stages of its life cycle:

- (i) *Growth*
- (ii) *Maturity*

Solution**Growth Stage**

Compared to the introduction stage the likely changes are as follows:

Unit Selling Prices:

These are likely to be reducing for a number of reasons:

- The product will become less unique as competitors use reverse engineering to introduce their versions of the product.
- Netcom may wish to discourage competitors from entering the market by lowering the price and thereby lowering the unit profitability.
- The price needs to be lowered so that the product becomes attractive to different market segments thus increasing demand to achieve the growth in sales volume.

Unit Production Costs:

These are likely to reduce for a number of reasons:

- Direct materials are being bought in larger quantities and therefore Netcom may be able to negotiate better prices from its suppliers thus causing unit material costs to reduce.
- Direct labour costs may be reducing if the product is labour intensive due to the effects of the learning and experience curves.
- Other variable overhead costs may be reducing as larger batch sizes reduce the cost of each unit.
- Fixed production costs are being shared by a greater number of units.

Maturity Stage

Compared to the growth stage the likely changes are as follows:

Unit Selling Prices:

These are unlikely to be reducing any longer as the product has become established in the market place. This is a time for consolidation and whilst there may be occasional offers to tempt customers to buy the product the selling price is likely to be fairly constant during this period.

Unit Production Costs:

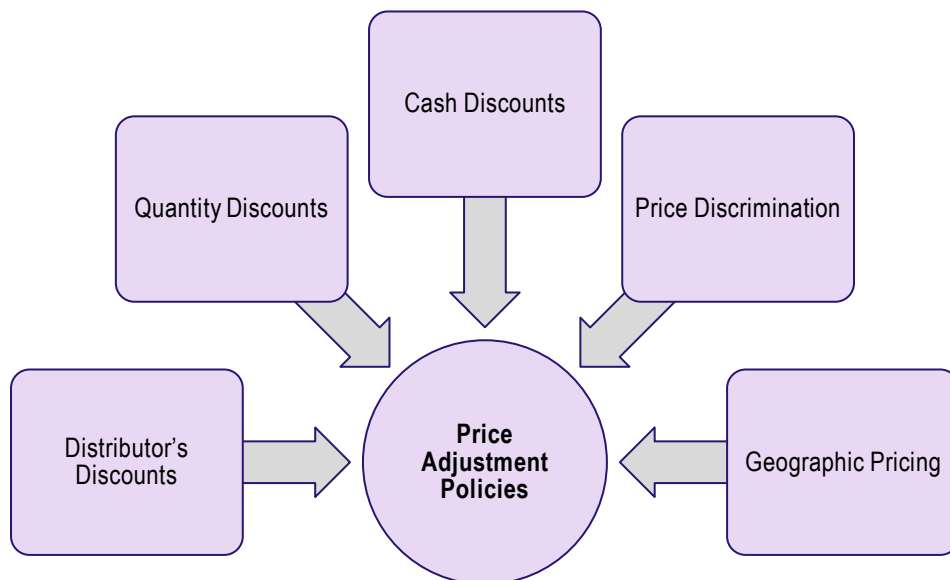
Direct material costs are likely to be fairly constant in this phase and may even rise as the quantities required diminish compared to those required in the growth stage with the consequential loss of negotiating power.

Direct labour costs are unlikely to be reducing any longer as the effects of the learning and experience curves have ended. Indeed the workers may have started working on the next product so that their attention towards this product has diminished with the result that these costs may increase.

Overhead costs are likely to be similar to those of the end of the growth phase as optimum batch sizes have been established and are more likely to be used in this maturity stage of the product life cycle where demand is more easily predicted.

PRICE ADJUSTMENT POLICIES

Having set prices, often companies will need to adjust their basic prices to account for various customer differences and changing situations. Companies, therefore, need to establish price adjustment policies are as follows:

*Distributor's Discounts*

It means price deductions that systematically make the net price vary according to buyer's position in the chain of distribution. These discounts are given to various distributors in the trade channel e.g., wholesalers, dealers and retailers. As these discounts creates differential prices for different

customers on the basis of marketing functions performed by them, so these are also called as functional discounts.

Quantity Discounts

Quantity discounts are price reductions related to the quantities purchased. It may take several forms. It may be related to the size of the order which is being measured in terms of physical units of a particular commodity. This is practicable where the commodities are homogeneous or identical in nature, or where they may be measured in terms of truck-loads. However, this method is not applicable in the case of heterogeneous commodities as it is difficult to add them in terms of physical units or truck loads e.g. textile and drug industry. Quantity discounts are useful in the marketing of materials and supplies but are rarely used for marketing equipment and components.

Cash Discounts

Cash discounts are price reductions based on promptness of payment. It is a convenient device to identify and overcome bad credit risks. In those trades where credit risk is high, the percentage of cash discount given is also high. If a buyer decides to purchase goods on credit, he has to pay a higher price by foregoing the cash discount.

Price Discrimination

Price discrimination means charging different prices and it takes various forms according to whether the basis is customer, product, place or time. Price discrimination is possible if the following conditions are satisfied:

- the maker must be capable of being segmented for price discrimination;
- the customers should not be able to resell the product of the segment paying higher price; and
- the chance of competitors' underselling in the segment of higher prices should not be possible.

Under *time differentials* the objective of the seller is to take advantage of the fact that buyer's demand elasticity vary over time.

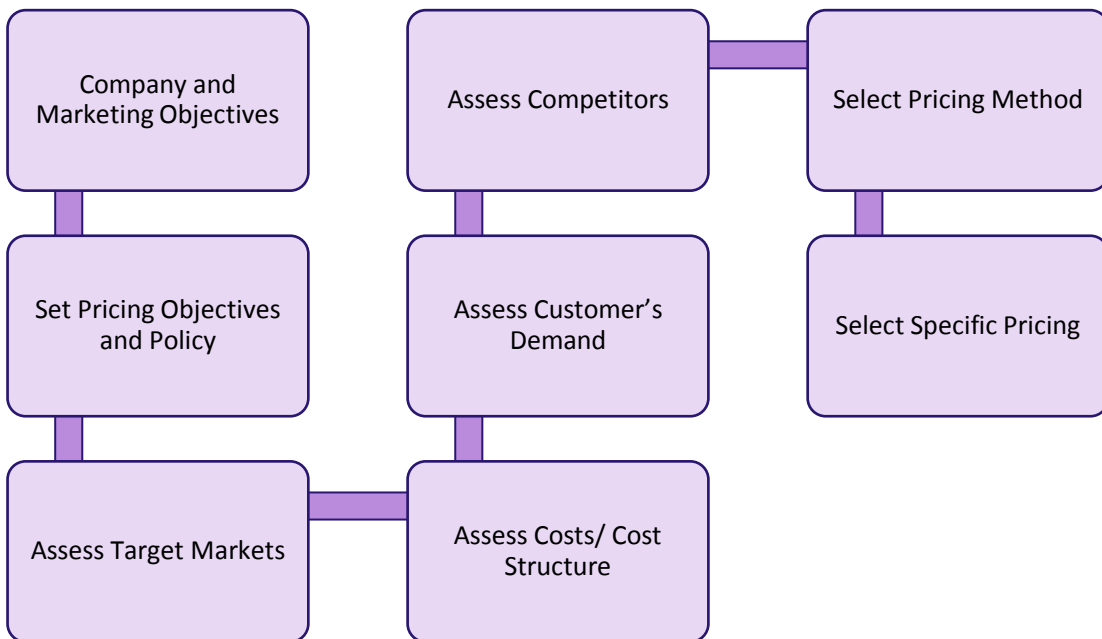
Geographic Pricing

In pricing, a seller must consider the costs of shipping goods to the buyer. These costs grow in importance as freight becomes a larger part of total variable costs. Pricing policies may be established whereby the buyer pays all the freight expense, the seller bears the entire cost, or the seller and buyer share this expense. The strategy chosen can influence the geographic limits of a firm's market, locations of its production facilities, sources of its raw materials, and its competitive strength in various geographic markets.



STRUCTURED APPROACH TO PRICING DECISIONS

Logical and acceptable way of structuring the process:



(Source: CIM Course book 06/07 Marketing Fundamentals By Frank Withey, Geoff Lancaster)



SENSITIVITY ANALYSIS IN PRICING DECISIONS

Sensitivity analysis is very significant in making pricing decisions, and striking the right balance in which the price is good-looking enough to generate enough sales, yet is also profitable for the firm. It is also important for determining how much can be spent on development or marketing, etc. Simple analysis of past pricing decisions can inscribe poor pricing controls, and sources of value leakage and more sophisticated price sensitivity analysis can identify opportunities to increase or decrease prices to drive sales.

Product pricing decisions must be balanced against costs and competitive market conditions. Sensitivity analysis is required to determine how sales and costs will respond to changes in the market conditions.

Sensitivity analysis is performed by choosing the critical parameters upon which we based our pro forma computations, and systematically changing them to assess how the changes will affect the overall outcome. Some of these factors are external, and change according to the market and economy. This analysis is important towards understanding how the company will withstand external changes, for example:

- Market Demand
- Changes in Market Prices
- Exchange Rate Fluctuation

Other factors are typically internal, and in these cases sensitivity analysis is valuable in making important decisions within the company. For example:

- Initial Outlay, R & D
- Production Cost
- Marketing Costs
- Introduction Dates
- Product Prices

(Source: *How to Create a Successful Business Plan* By Dan Galai, Lior Hillel, Daphna Wiener; *Introduction to Managerial Accounting* By Larry M. Walther, Christopher J. Skousen)



PRICING OF SERVICES: ISSUES

- When services are uniquely tailored to each customer's needs, the pricing cannot be easy. Each service transaction is likely to have *distinct pricing structure*.
- In certain services customer's participation is essential. The customer may have to incur certain intangible costs over and above monetary cost while making use of a service. The pricing decision in such services should *accommodate the intangible costs* that a customer may have to bear with.
- Some of the services like health care, education, communication, transport, etc. fall within the larger domain of government. Therefore, price of those *services tends to be regulated*.
- Some services pricing is determined in a *collective manner*. Trade association, professional bodies, or other institutions may impose broad guidelines for fixing the price.



SUMMARY

- Theory of Price –The basic approach in most of the micro-economic theory (theory of the individual firm and its relation to other firms) defines the term optimum price as that price which yields the maximum profits (excess of total revenues over total costs). It also assumes that the firm takes into consideration the position of demand and cost functions and that the firm produces one product.
- Pricing Model – Pricing model is a mathematical model which uses economic theory of pricing.
 - (i) As per economic theory of pricing, Profit is Maximum at a level of output where Marginal Revenue (MR) is equal to Marginal Cost (MC). This model determines the level of production up to which production can be continued.
 - (ii) The Basic Price Equation, which is used to determine the Price where Profit is Maximum.

The equation is written as:

$$P = a - bQ,$$

Where,

P = Price,

b = Slope of the Demand curve, Calculated as $\left[b = \frac{\text{Change in Price}}{\text{Change in Quantity}} \right],$

Q = Quantity Demanded,

a = Price at which demand is zero.

(iii) The Marginal Revenue equation is written as:

$$\text{Marginal Revenue (MR)} = P = a - 2bQ$$

▪ Pricing under Different Market Structures –

(i) Perfect Competition – Under this type of market, firm has no pricing policy of its own as the sellers are price takers (i.e. it has to accept the price determined by the market) and sell as much as they are capable of selling at the prevailing market price.

(ii) Monopoly – Under the monopoly, a firm is a price setter i.e. it can fix any price but here also the pricing is done taking elasticity of demand for the product into consideration. That means though the seller/ producer can fix any price but it will go for the price where demand for the product and consequent profit will be maximum.

(iii) Monopolistic Competition – Under monopolistic condition, consumers may buy more at a lower price than at higher price. The profit can be maximised by equating marginal revenue with marginal cost.

(iv) Oligopoly – The oligopolistic firm, while determining the price for its product, consider not only the demand for the product but also the reactions of the other firms in the industry to any action or decision it may take.

▪ Pricing Strategies of Oligopolies –

(i) Predatory Pricing – Keeping price artificially low, and often below the full cost of production.

(ii) Limit-Pricing Strategy to discourage entrants, which is also called entry forestalling price.

(iii) Collusion with rivals and raise price together, but this may attract new entrants.

(iv) Cost-Plus Pricing – A straightforward pricing method, where a firm sets a price by calculating average production costs and then adding a fixed mark-up to achieve a desired profit level.

Non-Price Strategies – Non-price competition is the favoured strategy for oligopolists because price competition can lead to destructive price wars. Strategies like improving

Quality & After Sales Servicing, Spending on Advertising, Sponsorship, and Product Placement etc.

- Pricing Policy – Although cost is an important aspect of pricing, consumer demand and competitive environment are frequently far more significant in pricing decisions.
- Creating value for the customers is one of the important objectives of a firm. A firm makes all the efforts to create value and to achieve this it formulates its marketing strategy in that direction.
- Price Sensitivity – It measures the customer's behaviour to the change in price of a product. Nine factors that contribute to price sensitivity are Unique Value Effect, Substitute Awareness Effect, Difficult Comparison Effect, Total Expenditure Effect, End- Benefit Effect, Shared Cost Effect, Sunk Investment Effect, Price Quality Effect and Inventory Effect.
- Controlled experimentation for measuring price sensitivity – In this method, customers are offered different brands at different prices and customer's responses are obtained. Then the company's brand prices are changed and customer's response at each price level is recorded. The price at which demand for the product starts declining is the level where price sensitivity begins and based on the response level, sensitivity can be measured. It depends on the nature of the product and buyer characteristics.
- Price Customization – Price customisation is done in various ways –
 - (i) Based on product line, (ii) Based on customer's past behaviour, (iii) Based on demographics and (iv) Based on time differential.
- Pricing Methods –
 - (i) Cost-Based Pricing Method – estimate the cost of product & fix a margin of profit. The term 'cost' here means Full Cost at current output and wages level since these are regarded as most relevant in price determination.

Pricing based on total costs is subjected to two limitations viz arbitrary allocation of inter-departmental overheads and estimation of normal output.

In order to avoid these complications, Variable Costs which are considered as relevant costs are used for pricing, by adding a markup (to include fixed costs allocation also).
 - (ii) Competition-Based Pricing Method – When a company sets its price mainly on the consideration of what its competitors are charging, its pricing policy under such a situation is called competitive pricing or competition-oriented pricing.

Going Rate Pricing – It is a competitive pricing method under which a firm tries to keep its price at the average level charged by the industry. The use of such a practice of pricing is especially useful where it is difficult to measure costs.

Sealed Bid-Pricing – Competitive pricing dominates in those situations where firms compete on the basis of bids, such as original equipment manufacturer and defense contract work.

- (iii) Value- Based Pricing Method – to price the product on the basis of customer's perception of its value.
 - Objective Value or True Economic Value (TEV) –
$$\text{TEV} = \text{Cost of the Next Best Alternative} + \text{Value of Performance Differential}$$
- Strategic Pricing of New Products – A new product is analysed into three categories for the purpose of pricing –
 - (i) Revolutionary Product – Revolutionary product may enjoy the premium price as a reward for its innovation and taking first initiative.
 - (ii) Evolutionary Product – The evolutionary products may be priced taking cost-benefit, competitor, and demand for the product into account.
 - (iii) Me-too Product – The me-too products are price takers as the price is determined by the market mainly by the competitive forces.
- While preparing to enter the market with a new product, management must decide whether to adopt a skimming or penetration pricing strategy.
 - (i) Skimming Pricing – It is a policy of high prices during the early period of a product's existence. This can be synchronised with high promotional expenditure and in the later years the prices can be gradually reduced.
 - (ii) Penetrating Pricing, means a pricing suitable for penetrating mass market as quickly as possible through lower price offers. The company may not earn profit by resorting to this policy during the initial stage. Later on, the price may be increased as and when the demand picks up.
- Predatory Pricing (loss leading) is the practice of selling a product or service at a very low price, intending to drive competitors out of the market or create barriers to entry for potential new competitors.
- Price Adjustment Polices –
 - (i) Distributor's Discounts – It means price deductions that systematically make the net price vary according to buyer's position in the chain of distribution.
 - (ii) Quantity discounts are price reductions related to the quantities purchased.
 - (iii) Cash discounts are price reductions based on promptness of payment.
 - (iv) Price Discrimination – charging different prices and it takes various forms according to whether the basis is customer, product, place or time.
 - (v) Geographic Pricing – Pricing policies may be established whereby the buyer pays all the freight expense, the seller bears the entire cost, or the seller and buyer share this expense. The strategy chosen can influence the geographic limits of a firm's market, locations of its production facilities, sources of its raw materials, and its competitive strength in various geographic markets.

- Pricing and Product Life Cycle
 - (i) Introduction Stage – *Skimming Policy* with high prices, but low profit margin due to high fixed costs. Growth Stage - Reduce price to penetrate market further. Maturity Stage - Price to match or beat competitor. Decline Stage - Cut price if not repositioning.
 - (ii) Introduction Stage – *Penetration Policy* to enter the market and gain a high share quickly or to prevent competitors from entering. Maturity Stage - Retain higher prices in some market segments. Decline Stage - Some increases in prices may occur in the late decline stage.
- Pricing of Services (Issues) – Each service transaction is likely to have distinct pricing structure, accommodation of the intangible costs that a customer may have to bear with, pricing regulated by government or collective groups like trade associations in certain specific sectors.
- If the selling price is below the total cost but above the marginal cost the contribution will leave an under-recovery of fixed expenses. If the product is sold at marginal cost, the loss will be there to the extent of fixed expenses. If sold at a price less than the marginal cost, the loss will be greater than fixed expenses.
- In periods of recession, a firm may sell its articles at a price less than the total cost but above the marginal cost for a limited period.
- It may also be justifiable to sell the product at a price below marginal cost for a limited period provided the materials are of perishable nature, stocks are huge and market prices have fallen, reduction results in increased sales of other products having larger profit margin.
- Differential selling prices, which is above, the marginal cost but below the total cost is resorted to in order to absorb surplus capacity. This can be done in two ways either dumping of branded products in another market above marginal cost, or the firm may produce and sell a branded article, say product A, which covers the entire fixed overheads and use the surplus capacity to produce another product B, which may be sold at a price above its marginal cost.



TEST YOUR KNOWLEDGE

Pricing and Product Life Cycle

1. Swift Tech Ltd. (STL) is a leading IT security solutions and ISO 9001 certified company. The solutions are well integrated systems that simplify IT security management across the length and depth of devices and on multiple platforms. STL has recently developed an Antivirus Software and company expects to have life cycle of less than one year. It was decided that it would be appropriate to adopt a market skimming pricing policy for the launch of the product. This Software is currently in the Introduction stage of its life cycle and is generating significant unit profits.

Required

- (i) EXPLAIN, with reasons, the changes, if any, to the unit selling price that could occur when the Software moves from the Introduction stage to Growth stage of its life cycle.
- (ii) Also, IDENTIFY necessary strategies at this stage.

Profit Maximization Model

2. Baithway India Ltd. (BIL) is an ISO 9001:2008, a premier multi-discipline company. BIL manufactures a diverse range of products viz. Pressure Vessels, Wagons, Steel Castings etc. To manufacture Wagons, BIL undertake structural fabrication jobs and manufacturing, retrofitting of EOT crane. It is presently the flagship company of the Baithway Group comprising of renowned companies such as Krishna Agriculture, Chiang Phosphate etc. The Group was launched with the idea of one virtual company with diversified businesses, and is based on four fundamental principles - Collaboration, Sustainability, Inclusiveness and being Global.

Baithway India Ltd. has two Divisions namely, Bogie Division (BD) and Wagon Division (WD) for manufacturing of Wagon. 'BD' manufactures Bogies and 'WD' manufactures various type of Wagons like Freight Wagon, Tank Wagon, Special Wagon etc. To manufacture a Wagon, 'WD' needs 4 Bogies. 'BD' is the only manufacturer of the Bogies and supplies both 'WD' and outside customers. Details of 'BD' and 'WD' for the coming financial year 2018-19 are as follows:

	BD	WD
Fixed Costs (₹)	9,20,20,000	16,45,36,000
Variable Cost per unit (₹)	2,20,000	4,80,000*
Capacity per month (units)	320	12

* excluding transfer costs

Market research has indicated that the demands in the market for Baithway India Ltd.'s products at different quotations are as follows-

For Bogies: Quotation price of ₹3,20,000 no tender will be awarded, but demand will increase by 30 Bogies with every ₹10,000 reduction in the unit quotation price below ₹3,20,000.

For Wagons: Quotation price of ₹17,10,000 no tender will be awarded, but the demand for Wagons will be increased by 2 Wagons with every ₹50,000 reduction in the unit quotation price below ₹17,10,000.

Further, 'BD' is the only manufacturer of Bogies but due to increased demand, competitors are entering the market. The division is reviewing its pricing policy and carrying out some market research. After the market research, the division 'BD' has decided to introduce new type of "E" Class Bogies in the market and to obtain the patent right for such unique Bogies. High growth in future characterizes this Class.

Required

- (i) CALCULATE the unit quotation price of the Wagon that will maximise Baithway India Ltd.'s profit for the financial year 2018-19.
- (ii) CALCULATE the unit quotation price of the Wagon that is likely to emerge if the divisional managers of 'BD' and 'WD' both set quotation prices calculated to maximise divisional profit from sales to outside customers and the transfer price is set at market selling (quotation) price.

[Note: If $P = a - bQ$ then $MR = a - 2bQ$]

- (iii) RECOMMEND appropriate pricing strategy while introducing the "E" Class Bogies.

Pricing Methods

3. The budgeted cost data of a product manufactured by Ayudhya Ltd. is furnished as below:

Budgeted units to be produced	2,00,000
Variable cost (₹)	32 per unit
Fixed cost (₹)	16 lacs

It is proposed to adopt cost plus pricing approach with a mark-up of 25% on full budgeted cost basis.

However, research by the marketing department indicates that demand of the product in the market is price sensitive. The likely market responses are as follows:

Selling Price (₹ per unit)	44	48	50	56	60
Annual Demand (units)	1,68,000	1,52,000	1,40,000	1,28,000	1,08,000

Required

ANALYSE the above situation and DETERMINE the best course of action.

**ANSWERS/ SOLUTIONS**

1. Following acceptance by early innovators, conventional consumers start following their lead. New competitors are likely to now enter the market attracted by the opportunities for large scale production and profit. STL may wish to discourage competitors from entering the market by lowering the price and thereby lowering the unit profitability. The price needs to be lowered so that the product becomes attractive to different market segments thus increasing demand to achieve the growth in sales volume.

Strategies at this stage may include the following

- (i) Improving quality and adding new features such as Data Theft Protection, Parental Control, Web Protection, Improved Scan Engine, Anti Spyware, Anti Malware etc.
- (ii) Sourcing new market segments/ distribution channels.

- (iii) Changing marketing strategy to increase demand.
 (iv) Lowering price to attract price-sensitive buyers.
2. (i) Assumed Quotation Price 'P', Quantity 'Q'

The Marginal Cost of a 'Wagon' is ₹13,60,000
 (₹2,20,000 × 4 Bogies + ₹4,80,000)

Demand Function for a 'Wagon'

$$P = ₹17,10,000 - (\₹50,000 / 2) \times Q$$

$$\begin{aligned} \text{Revenue (R)} &= Q \times [17,10,000 - 25,000 \times Q] \\ &= 17,10,000 Q - 25,000 Q^2 \end{aligned}$$

$$\text{Marginal Revenue (MR)} = 17,10,000 - 50,000 Q$$

$$\text{Marginal Cost (MC)} = 13,60,000$$

Profit is Maximum where Marginal Revenue (MR) equals to Marginal Cost (MC)

$$17,10,000 - 50,000 Q = 13,60,000$$

$$Q = 7.00 \text{ units}$$

By putting the value of 'Q' in *Demand Function*, value of 'P' is obtained.

$$\begin{aligned} P &= 17,10,000 - (50,000/2) \times Q \\ &= 17,10,000 - 25,000 \times 7.00 \\ &= ₹15,35,000 \end{aligned}$$

At ₹15,35,000 unit Quotation Price of a Wagon, the Baithway Company Ltd.'s Profit will be Maximum.

- (ii) At 'BD' the Divisional Manager would ensure that Divisional Marginal Revenue should be **equal to** Division's Marginal Cost so that Profit can be Maximum.

$$\text{MR of a Bogies} = \text{MC of Manufacturing a Bogies}$$

$$3,20,000 - 2(10,000/30) \times Q = 2,20,000$$

$$Q = 150 \text{ units}$$

Selling Price of a Bogie i.e 'P' is

$$\begin{aligned} P &= 3,20,000 - (10,000/30) \times 150 \\ &= ₹2,70,000 \end{aligned}$$

'BD' will earn Maximum Profit when it will Quote ₹2,70,000 to the Outside Market. Since, Outside Market Quotation is *Transfer Price* as well, so Transfer Price to WD will be ₹2,70,000 and it forms part of WD's Marginal Cost.

At 'WD', Division Manager would ensure that Divisional Marginal Revenue should be **equal to** Division's Marginal Cost so that Profit can be Maximum.

$$\begin{aligned}
 \text{MR of a Wagon} &= \text{MC of Manufacturing a Wagon} \\
 17,10,000 - 50,000 \times Q &= (2,70,000 \times 4 \text{ Bogies}) + ₹4,80,000 \\
 Q &= 3.00 \text{ units} \\
 \text{Quotation Price of a Wagon 'P' should be:} \\
 P &= ₹17,10,000 - 25,000 \times 3.00 \\
 &= ₹16,35,000
 \end{aligned}$$

The unit Quotation Price of Wagon that emerges as a result of Market Based Transfer Pricing is ₹16,35,000.

- (iii) Whenever a new product is launched into the market, management can adopt either Skimming or Penetration strategy.

The idea behind Skimming Strategy is to intentionally keep a price high to recover the high R&D and marketing expenses associated with developing a new product. For Price Skimming to work, the product must be perceived as having unique advantage over its competing products, very difficult to copy or protected by patents.

Division 'BD' may follow Skimming Strategy by taking advantage of the distinctive features of Bogie "E". High prices in the early stages of a Bogies' life cycle are expected to generate high initial cash flows, this will help the division to recover the high development costs it would incur. Further, this new Bogie "E" is protected from competition through entry barrier. Such barrier is patent.

With Penetration Strategy, a low price is initially charged for the product rather than high prices. The idea behind this is that the price will make the product accessible to many buyers and therefore the high sales will compensate for the lower prices being charged. This penetration pricing is adopted for rapid market acceptance, maximum sales and discouraging competition from the market, however this strategy is not for all companies since it requires a cost structure and scale economics that remain unaffected by narrow profits margin.

The circumstances which may favor a penetration pricing policy are:

- Highly elastic demand for the product, i.e. the lower the price, the higher the demand. This situation is not mentioned in this case for Bogies "E".
- If significant economies of scale could be achieved so that higher sales volumes would result in reductions in costs. However, in this case, it cannot be ascertained.
- Where entry barriers are low, however in this case, new competitors cannot enter the market as Bogies "E" is protected by patent.
- If company desires to shorten the initial period of the product's life-cycle to enter the growth and maturity stages quickly, however, there is no evidence the division 'BD' wish to do this.

Overall, Due to the uniqueness, heavy R&D cost, and barrier to entry for competitor, a market skimming pricing strategy is appeared to be the more appropriate pricing strategy for Bogle “E”.

3. Analysis of Cost *plus* Pricing Approach

The company has a plan to produce 2,00,000 units and it proposed to adopt **Cost *plus* Pricing** approach with a markup of 25% on full budgeted cost. To achieve this pricing policy, the company has to sell its product at the price calculated below:

Qty.	2,00,000 units
Variable Cost (2,00,000 units × ₹ 32)	64,00,000
Add: Fixed Cost	16,00,000
Total Budgeted Cost	80,00,000
Add: Profit (25% of ₹ 80,00,000)	20,00,000
Revenue (need to earn)	1,00,00,000
Selling Price <i>per unit</i> $\left(\frac{₹ 1,00,00,000}{2,00,000 \text{ units}} \right)$	50 p.u.

However, at selling price ₹50 per unit, the company can sell 1,40,000 units only, which is 60,000 units less than the budgeted production units.

After analyzing the price-demand pattern in the market (which is price sensitive), to sell all the budgeted units market price needs to be further lowered, which might be lower than the total cost of production.

Statement Showing “Profit at Different Demand & Price Levels”

	I	II	III	IV	Budgeted
Qty. (units)	1,68,000	1,52,000	1,40,000	1,28,000	1,08,000
	₹	₹	₹	₹	₹
Sales	73,92,000	72,96,000	70,00,000	71,68,000	64,80,000
Less: Variable Cost	53,76,000	48,64,000	44,80,000	40,96,000	34,56,000
Total Contribution	20,16,000	24,32,000	25,20,000	30,72,000	30,24,000
Less: Fixed Cost	16,00,000	16,00,000	16,00,000	16,00,000	16,00,000
Profit (₹)	4,16,000	8,32,000	9,20,000	14,72,000	14,24,000
Profit (% on total cost)	5.96	12.87	15.13	25.84%	28.16%

Determination of the Best Course of Action

- (i) Taking the above calculation and analysis into account, the company should produce and sell 1,28,000 units at ₹56. At this price company will not only be able to achieve its desired mark up of 25% on the total cost but can earn maximum contribution as compared to other even higher selling price.
- (ii) If the company wants to uphold its proposed pricing approach with the budgeted quantity, it should try to reduce its variable cost per unit for example by asking its supplier to provide a quantity discount on the materials purchased.