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 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 Chapters 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 content 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.

In case you need any further clarification/guidance, you may send your queries at deepak.gupta@icai.in
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 within organisations

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   (ii) Limitations of Traditional Cost Management
   (iii) Traditional vs. Strategic Cost Management

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   (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
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       f) Six Sigma (SS)
   (ii) Introduction to Process Innovation and Business Process Re-engineering (BPR)

4. Cost Management Techniques
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Applications of the following Quantitative Techniques are required to be studied to linkage to course concept:
(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
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 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.

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

<table>
<thead>
<tr>
<th>Particulars</th>
<th>A</th>
<th>B</th>
</tr>
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<tr>
<td>Revenue</td>
<td>60</td>
<td>35</td>
</tr>
<tr>
<td>Cost of Sales</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Gross Profit</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Overheads</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Net Profit</td>
<td>20</td>
<td>-2</td>
</tr>
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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 production of 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”:

1. Formulating strategies
2. Communicating those strategies throughout the organization
3. Developing and carrying out tactics to implement the strategies
4. Developing and implementing controls to monitor the success of objectives
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

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

(i) **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.

(ii) **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.

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**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.

![Strategic Framework Diagram](image)

**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.

<table>
<thead>
<tr>
<th>How IKEA Reconfigured the Furniture Industry?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value Chain</strong></td>
</tr>
<tr>
<td>Design</td>
</tr>
<tr>
<td>Parts</td>
</tr>
<tr>
<td>Assembly</td>
</tr>
<tr>
<td>Transport/ Stocking</td>
</tr>
<tr>
<td>Marketing</td>
</tr>
<tr>
<td>Display</td>
</tr>
<tr>
<td>Home delivery</td>
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</table>

*Source: Normann and Ramirez, 1993*

- **How Tetra-Pak Reconfigured the Value Chain?**

<table>
<thead>
<tr>
<th>Filling</th>
<th>Transport</th>
<th>Retail Display</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make container on site</td>
<td>No refrigerated trucks</td>
<td>Low store handling</td>
<td>Longer shelf life</td>
</tr>
<tr>
<td>Tetra - Pak specialised equipment</td>
<td>No wastage space in filling &amp; packing</td>
<td>No need to refrigerate &amp; less space is required</td>
<td>No need to refrigerate &amp; less space is required</td>
</tr>
</tbody>
</table>

- **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 businesses to assess the competitive advantage. Companies must not only focus on the end product/service but also on the process/activities involved in the 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 firms 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 an 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 –

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<thead>
<tr>
<th>Key Questions</th>
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<tbody>
<tr>
<td>What kind of products/services will the company offer?</td>
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<tr>
<td>Which is the primary market for its offering?</td>
</tr>
<tr>
<td>What type of customers does the company seek to target?</td>
</tr>
<tr>
<td>What is the area of operation (geographies)?</td>
</tr>
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</table>

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 works 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.

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INTRODUCTION TO STRATEGIC COST MANAGEMENT

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.
INTRODUCTION TO STRATEGIC COST MANAGEMENT

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
INTRODUCTION TO STRATEGIC COST MANAGEMENT

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.
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
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 into 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 mediate 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.

Cost of Quality (COQ)

\[ \text{Cost of Quality (COQ)} = \text{Cost of Control} + \text{Cost of Failure of Control} \]

\[ \text{Cost of Control} = (\text{Prevention Cost} + \text{Appraisal Cost}) \]

\[ \text{Cost of Failure of Control} = (\text{Internal Failure Cost} + \text{External Failure Cost}) \]

- In its simplest form, COQ can be calculated \textit{in terms of effort} (hours/days).
- A better approach will be to calculate COQ \textit{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 \textit{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

(i) ANALYSE the proposal and suggest if it would be beneficial for the company to implement it.

(ii) 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 an 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 the 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.
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- **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 organizational 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 have 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**

<table>
<thead>
<tr>
<th>Tata Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tata Steel</strong> 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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>With the Company’s better understanding of TQM and the Theory of Constraints (TOC) on the</td>
</tr>
</tbody>
</table>
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 Model**

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 organization does. The 'Results' criteria cover what an organization 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 Culture

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 accredit 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.


Business Excellence Model in Practice

<table>
<thead>
<tr>
<th>Tata Business Excellence Model</th>
</tr>
</thead>
</table>

The TBEM which has been adapted on the pattern of Malcolm Balridge 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 Constraints

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 utilised 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:

<table>
<thead>
<tr>
<th>Core Measures</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Throughput</strong> ($T$)</td>
<td>Throughput as a TOC measure is the rate of generating money in an organization through Sales.</td>
</tr>
<tr>
<td></td>
<td>Throughput = (Sales Revenue – Unit Level Variable Expenses)/ Time</td>
</tr>
<tr>
<td></td>
<td>Direct Labour Cost is viewed as a fixed unit level expenses and is not usually included.</td>
</tr>
<tr>
<td><strong>Investment</strong> ($I$)</td>
<td>This is money associated with turning materials into Throughput and do not have to be immediately expensed.</td>
</tr>
<tr>
<td></td>
<td>Includes assets such as facilities, equipment, fixtures and computers.</td>
</tr>
<tr>
<td><strong>Operating Expense</strong> ($OE$)</td>
<td>Money spent in turning Investment into Throughput and therefore, represent all other money that an organisation spends.</td>
</tr>
<tr>
<td></td>
<td>Includes direct labour and all operating and maintenance expenses</td>
</tr>
</tbody>
</table>

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:

\[
\frac{\text{Throughput}}{\text{Labour Cost}} \quad \text{and} \quad \frac{\text{Throughput}}{\text{Material Cost}}
\]
Illustration

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

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Product X</th>
<th>Product Y</th>
<th>Product Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling Price (₹)</td>
<td>66</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Material and Other Variable Cost (₹)</td>
<td>24</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Bottleneck Resource Time (Minutes)</td>
<td>15</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

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

Required

(i) Company adopted throughput accounting and products are ranked according to ‘product return per minute’. Select the highest rank product.

(ii) CALCULATE throughput accounting ratio and COMMENT on it.

Solution

(i) Calculation of Rank According to ‘Product Return per minute’

<table>
<thead>
<tr>
<th>Particulars</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling Price</td>
<td>66</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Variable Cost</td>
<td>24</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Throughput Contribution</td>
<td>42</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Minutes per unit</td>
<td>15</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Contribution per minute</td>
<td>2.8</td>
<td>3.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Ranking</td>
<td>II</td>
<td>I</td>
<td>III</td>
</tr>
</tbody>
</table>

(ii) Ranking Based on ‘TA Ratio’

<table>
<thead>
<tr>
<th>Particulars</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution per minute</td>
<td>2.80</td>
<td>3.00</td>
<td>2.50</td>
</tr>
<tr>
<td>Factory Cost per minute (2,21,600 / 75,120)</td>
<td>2.95</td>
<td>2.95</td>
<td>2.95</td>
</tr>
<tr>
<td>TA Ratio (Cont. per minute / Cost per minute)</td>
<td>0.95</td>
<td>1.02</td>
<td>0.85</td>
</tr>
<tr>
<td>Ranking Based on TA Ratio</td>
<td>II</td>
<td>I</td>
<td>III</td>
</tr>
</tbody>
</table>

Comment

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

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in inventory.</td>
<td>Focus on short-term goals as opposed to long-term with ABC.</td>
</tr>
<tr>
<td>More productive machines.</td>
<td>Main emphasis on increasing sales and volume, not quality as opposed to Total Quality Management.</td>
</tr>
<tr>
<td>Ability to meet shorter lead times.</td>
<td>Might result in loss of the overall picture while looking at specific constraints.</td>
</tr>
<tr>
<td>More flexible.</td>
<td>Focuses on the push approach as opposed to pull approach of JIT.</td>
</tr>
<tr>
<td>Better customer service.</td>
<td>Valid only if applied to the total supply chain process including management, production, resources and support.</td>
</tr>
<tr>
<td>Better product mix.</td>
<td>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.</td>
</tr>
<tr>
<td>Better customer relationship.</td>
<td></td>
</tr>
</tbody>
</table>

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**

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.

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.

When management learned about throughput, it shifted its focus from absorbing costs into
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.
Demand Management, provides the structure for optimising the customer's requirements with supply chain capabilities.

Order Fulfilment, includes all activities necessary to define customer requirements, design the logistics network, and fill customer orders.

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.

Product Development and Commercialization, provides the structure for developing and bringing to market new products jointly with customers and suppliers.

Returns Management, includes all activities related to returns, reverse logistics, gatekeeping, and avoidance.

(Source: Supply Chain Management: Processes, Partnerships, Performance By Douglas M. Lambert)

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

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Manufacturer</th>
<th>Distributer</th>
<th>Retailer</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply to Forecast</td>
<td>Production Based on Forecast</td>
<td>Inventory Based on Forecast</td>
<td>Stock Based on Forecast</td>
<td>Purchase What is Available</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Manufacturer</th>
<th>Distributer</th>
<th>Retailer</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply to Order</td>
<td>Produce to Order</td>
<td>Automatically Replenish Warehouse</td>
<td>Automatically Replenish Stock</td>
<td>Customer Orders</td>
</tr>
</tbody>
</table>
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.

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**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 Model** 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.


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:

1. Analyse the customer base and split it into the segments
2. Calculate the annual revenues earned from the customer
3. Calculate the annual costs of serving the segment
4. Identify and retain quality customers
5. Re-engineer/eliminate the unprofitable segments
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:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Years 1 and 2</th>
<th>Years 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spend on movie tickets per year</td>
<td>2,000</td>
<td>1,500</td>
</tr>
<tr>
<td>Spend on food and beverage per year</td>
<td>4,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Spend on souvenirs and accessories per year</td>
<td>2,250</td>
<td>750</td>
</tr>
</tbody>
</table>

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.

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

**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 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**

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**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 tends 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 Model

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.

**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. 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**

<table>
<thead>
<tr>
<th>Cost Savings initiatives and Gain Sharing arrangements at Chiang International:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Supplier will deliver 3% minimum cost savings on controllable portion of costs.</td>
</tr>
<tr>
<td>▪ Cost savings generated in first year as a result of Supplier idea will be retained by Supplier.</td>
</tr>
<tr>
<td>▪ Cost savings generated in year second will be shared between Chiang International and Supplier at a ratio of 40%:60%.</td>
</tr>
<tr>
<td>▪ Cost savings generated in year three will be passed along to Chiang International.</td>
</tr>
<tr>
<td>▪ 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.</td>
</tr>
</tbody>
</table>


**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.

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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**

<table>
<thead>
<tr>
<th>Parexel</th>
</tr>
</thead>
</table>

**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) Throughput = (Sales Revenue – Unit Level Variable Expenses)/ 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.

- **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 –
    
    o Customer Relationship Management – Understanding customer needs and providing them with the best possible solution to assist in customer retention and driving sales growth.
MODERN BUSINESS ENVIRONMENT


- 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:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling price</td>
<td>₹2,500 per unit</td>
</tr>
<tr>
<td>Raw material cost</td>
<td>₹900 per unit</td>
</tr>
<tr>
<td>Assembly &amp; machine cost</td>
<td>₹500 per unit</td>
</tr>
<tr>
<td>Delivery cost</td>
<td>₹100 per unit</td>
</tr>
<tr>
<td>Contribution</td>
<td>₹1,000 per unit</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th></th>
<th>DE Ltd.</th>
<th>PE Ltd.</th>
<th>ZE Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price quoted by supplier (per hundred units)</td>
<td>₹240</td>
<td>₹234</td>
<td>₹260</td>
</tr>
<tr>
<td>% of Defective of total receipts</td>
<td>3%</td>
<td>5%</td>
<td>2%</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th></th>
<th>₹ per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Material</td>
<td>35</td>
</tr>
<tr>
<td>Direct Labour</td>
<td>25</td>
</tr>
</tbody>
</table>
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.
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 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 view 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
compny 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 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**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>DE Ltd.</th>
<th>PE Ltd.</th>
<th>ZE Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units Supplies (No.s)</td>
<td>12,000</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Defectives Expected (No.s)</td>
<td>360</td>
<td>600</td>
<td>240</td>
</tr>
<tr>
<td>Costs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase of Components</td>
<td>28,800</td>
<td>28,080</td>
<td>31,200</td>
</tr>
<tr>
<td>Add: Production Damage on Defective Components (@ ₹200 per 100 components)</td>
<td>720</td>
<td>1,200</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>DE Ltd.</td>
<td>PE Ltd.</td>
<td>ZE Ltd.</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Units Supplies (No.s)</td>
<td>12,000</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Defects Not Expected (No.s)</td>
<td>36</td>
<td>60</td>
<td>24</td>
</tr>
<tr>
<td>Defectives Expected (No.s)</td>
<td>324</td>
<td>540</td>
<td>216</td>
</tr>
<tr>
<td>Components Paid For</td>
<td>11,676</td>
<td>11,460</td>
<td>11,784</td>
</tr>
<tr>
<td>Costs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase of Components</td>
<td>28,022.40</td>
<td>26,816.40</td>
<td>30,638.40</td>
</tr>
<tr>
<td>Add: Inspection Cost</td>
<td>3,120.00</td>
<td>3,120.00</td>
<td>3,120.00</td>
</tr>
<tr>
<td>Add: Production Damage on Defective Components (@ ₹200 per 100 components)</td>
<td>72.00</td>
<td>120.00</td>
<td>48.00</td>
</tr>
<tr>
<td>Total</td>
<td>31,214.40</td>
<td>30,056.40</td>
<td>33,806.40</td>
</tr>
<tr>
<td>Good Components (Nos.)</td>
<td>11,640</td>
<td>11,400</td>
<td>11,760</td>
</tr>
<tr>
<td>Cost per 100 Good Components</td>
<td>268.16</td>
<td>263.65</td>
<td>287.47</td>
</tr>
</tbody>
</table>

**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.

### Statement of ‘Expected Quality Costs’

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Current Situation (₹)</th>
<th>Proposed Situation (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention Costs</td>
<td>---</td>
<td>4,50,000</td>
</tr>
<tr>
<td>Appraisal Costs</td>
<td>---</td>
<td>50,000</td>
</tr>
<tr>
<td>External Failure Costs</td>
<td>3,20,000</td>
<td>2,35,120</td>
</tr>
<tr>
<td>Internal Failure Costs</td>
<td>7,55,556</td>
<td>3,91,538</td>
</tr>
<tr>
<td>Total Quality Costs</td>
<td>10,75,556</td>
<td>11,26,658</td>
</tr>
</tbody>
</table>

### Workings

#### External Failure Cost

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Current Situation</th>
<th>Proposed Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer's Demand</td>
<td>...(A)</td>
<td>28,000 units</td>
</tr>
<tr>
<td>Number of units Dispatched to Customers ...(B)</td>
<td>32,000 units</td>
<td>30,939 units</td>
</tr>
</tbody>
</table>
| \[
| \frac{28,000 \text{ units}}{87.5\%} ; \frac{28,000 \text{ units}}{90.5\%} |
| \]
| Number of units Replaced             | ...(B) – (A)       | 4,000 units        | 2,939 units        |
| External Failure Cost                | ₹3,20,000         | ₹2,35,120          |
| \{4,000 \text{ units} \times ₹(35+25+15+5)}; \{2,939 \text{ units} \times ₹(35+25+15+5)} |               |                   |
Internal Failure Cost

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Current Situation</th>
<th>Proposed Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of units Dispatched to Customers …(A)</td>
<td>32,000 units</td>
<td>30,939 units</td>
</tr>
<tr>
<td>Number of units Produced &amp; Rejected …(B)</td>
<td>40,000 units</td>
<td>34,377 units</td>
</tr>
<tr>
<td>32,000 units  [80%]</td>
<td></td>
<td>30,939 units  [90%]</td>
</tr>
<tr>
<td>Number of units Discovered Faulty … (B) – (A)</td>
<td>8,000 units</td>
<td>3,438 units</td>
</tr>
<tr>
<td>Cost of Faulty Production ...(D)</td>
<td>₹6,00,000</td>
<td>₹2,57,850</td>
</tr>
<tr>
<td>{8,000 units × (₹35+25+15)};</td>
<td></td>
<td></td>
</tr>
<tr>
<td>{3,438 units × (₹35+25+15)}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Scrapped</td>
<td>4,444.44 units</td>
<td>3,819.67 units</td>
</tr>
<tr>
<td>40,000 units  [90%]×10%</td>
<td></td>
<td>34,377 units  [90%]×10%</td>
</tr>
<tr>
<td>Cost of Material Scrapped ...(E)</td>
<td>₹1,55,556</td>
<td>₹1,33,688</td>
</tr>
<tr>
<td>{4,444.44 units × ₹35}; {3,819.67 units × ₹35}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Failure Cost ...(D)+(E)</td>
<td>₹7,55,556</td>
<td>₹3,91,538</td>
</tr>
</tbody>
</table>

(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 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 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:
<table>
<thead>
<tr>
<th>Particulars</th>
<th>Amount (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in throughput contribution (additional 50 camera units ₹1,500 per camera unit)</td>
<td>75,000</td>
</tr>
<tr>
<td>Less: Increase in total expenditure</td>
<td>40,000</td>
</tr>
<tr>
<td>Incremental benefit</td>
<td>35,000</td>
</tr>
</tbody>
</table>

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 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.
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
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
### STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

- **5S**
- **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.
“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 black-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. –

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“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:

<table>
<thead>
<tr>
<th>Month</th>
<th>Demand (Std. Hrs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan’19</td>
<td>3,150</td>
</tr>
<tr>
<td>Feb’19</td>
<td>3,760</td>
</tr>
<tr>
<td>Mar’19</td>
<td>4,060</td>
</tr>
<tr>
<td>Apr’19</td>
<td>3,350</td>
</tr>
<tr>
<td>May’19</td>
<td>3,650</td>
</tr>
<tr>
<td>Jun’19</td>
<td>4,830</td>
</tr>
</tbody>
</table>

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

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

(*) in terms of standard labour hours

Inventory Holding Cost for the six months = ₹2,57,600

\( \text{₹22,750} + \text{₹46,900} + \text{₹39,200} + \text{₹45,850} + \text{₹66,850} + \text{₹36,050} \)

Calculation of Relevant Overtime Cost under JIT System

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

(*) in terms of standard labour hours

Total Overtime payment = ₹2,16,583

\( \text{₹43,652} + \text{₹1,72,931} \)

Therefore, saving in JIT system = ₹2,57,600 – ₹2,16,583

= ₹41,017

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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.
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.

*(Source: Managerial Accounting 7E By Hilton)*
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

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, Healthcare, 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 cleanliness. 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

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

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

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.

Performance × Availability × Quality = 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:

<table>
<thead>
<tr>
<th>Availability</th>
<th>&gt; 90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>&gt; 95%</td>
</tr>
<tr>
<td>Quality</td>
<td>&gt; 99%</td>
</tr>
</tbody>
</table>

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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**

<table>
<thead>
<tr>
<th>Days per week</th>
<th>…(A)</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shifts per week</td>
<td>…(B)</td>
<td>2</td>
</tr>
<tr>
<td>Total Working Shifts per week</td>
<td>…(C = A × B)</td>
<td>12</td>
</tr>
<tr>
<td>Total Weeks</td>
<td>…(D)</td>
<td>4</td>
</tr>
<tr>
<td>Total Shifts</td>
<td>…(E = C × D)</td>
<td>48</td>
</tr>
</tbody>
</table>

**Calculation of Loss of Time per shift**

<table>
<thead>
<tr>
<th>Breakdown Maintenance (in mins)</th>
<th>360</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set up Changes (in mins)</td>
<td>900</td>
</tr>
<tr>
<td>Power Failure (in mins)</td>
<td>240</td>
</tr>
<tr>
<td>Total</td>
<td>…(A)</td>
</tr>
<tr>
<td>Loss of Minutes per shift</td>
<td>…(A/ 48)</td>
</tr>
</tbody>
</table>
### 3.26 STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

| Add: Lunch Breaks per shift | 45 |
| Add: Other Breaks            | 25 |
| Add: Preventive Maintenance  | 15 |
| **Total Time Loss** (in Minutes) **per shift** | **116.25** |

\[
\text{Availability Ratio per shift} = \frac{480 \text{ mins.} - 116.25 \text{ mins.}}{480 \text{ mins.}} \times 100\% = 75.78\%
\]

**Actual Production** = 120 units per shift

**Standard time** = 3 minutes

**Standard Time Required** = 120 units \times 3 minutes = 360 minutes

**Actual Time Taken** = 480 mins. – 116.25 mins. = 363.75 minutes

\[
\text{Performance Ratio} = \frac{360 \text{ mins.}}{363.75 \text{ mins.}} \times 100\% = 98.96\%
\]

**Quality Ratio** = \[ \frac{115 \text{ parts}}{120 \text{ parts}} \] \times 100\% = 95.83\%

Thus, OEE = \[ 0.7578 \times 0.9896 \times 0.9583 = 71.86\% \]

### 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

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

1. **Define** the problem, the project goals and customer requirements.
2. **Measure** the process to determine current performance.
3. **Analyze** the process to determine root causes of variation and poor performance (defects).
4. **Improve** the process by addressing and eliminating the root causes.
5. **Control** means maintaining the improved process and future process performance.

**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 unchanged.
- 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’.

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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 emphases 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:
LEARN SYSTEM AND INNOVATION

- 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.
## LEAN SYSTEM AND INNOVATION

### 3.35

<table>
<thead>
<tr>
<th><strong>DMAIC</strong></th>
<th><strong>DMADV</strong></th>
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<tbody>
<tr>
<td>Review the <em>existing processes</em> and fixes problem(s)</td>
<td>Emphases on the design of the product and processes.</td>
</tr>
<tr>
<td>More <em>reactive</em> process.</td>
<td><em>Proactive</em> process.</td>
</tr>
<tr>
<td>Increase the <em>capability</em>.</td>
<td>Increase the <em>capacity</em>.</td>
</tr>
<tr>
<td>Rupee benefits <em>quantified</em> rather quickly.</td>
<td>Rupee benefits more <em>difficult to quantify</em> and tend to be <em>much more long term</em>.</td>
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</table>

### Examples of DMAIC problem-solving methods:
- 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 development method is designed to address:
- 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**

<table>
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<tr>
<th>Wipro</th>
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| 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**

<table>
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<tr>
<th>Ford Motor Company</th>
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<tr>
<td>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.</td>
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<tr>
<td>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.</td>
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**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
- Have 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
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**

- **Process Identification**
  Each task performed being re-engineered is broken down into a series of processes.

- **Process Rationalisation**
  Processes which are non-value adding, to be discarded.

- **Process Redesign**
  Remaining processes are redesigned.

- **Process Reassembly**
  Re-engineered processes are implemented in the most efficient manner.

**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

<table>
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<tr>
<th>Ford Motor Company</th>
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| 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)

<table>
<thead>
<tr>
<th>Bike Manufacturing Process</th>
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<tr>
<td>Bikes are assembled through passing them along a continuous moving band of metal &amp; 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.</td>
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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.
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) Performance × Availability × Quality = 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’.

<table>
<thead>
<tr>
<th>X-78</th>
<th>14 February 2019, Wednesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakdown, repair and start up time</td>
<td>68 minutes</td>
</tr>
<tr>
<td>Standard cycle time</td>
<td>2.5 minutes per tablet</td>
</tr>
<tr>
<td>Quality loss due to scrap, rework, and rejection</td>
<td>50 tablets</td>
</tr>
<tr>
<td>Total quantity produced</td>
<td>280 tablets</td>
</tr>
</tbody>
</table>

**Required**

**COMMENT** on OEE.

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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total time worked during the month</td>
<td>210 hrs.</td>
</tr>
<tr>
<td>Total production during the month</td>
<td>2,800 units</td>
</tr>
<tr>
<td>No. of units accepted out of total production</td>
<td>2,520 units</td>
</tr>
<tr>
<td>Standard time for actual production of the month</td>
<td>180 hrs.</td>
</tr>
<tr>
<td>Time lost during the month</td>
<td>28 hrs.</td>
</tr>
</tbody>
</table>

**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–

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Manufacturing</th>
<th>Outsourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average manufacturing cost per pair</td>
<td>BND 625</td>
<td>---</td>
</tr>
<tr>
<td>Purchase cost per pair</td>
<td>---</td>
<td>CNY 28</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Current Purchasing Policy (₹)</th>
<th>JIT Procurement System (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material procurement cost per year</td>
<td>12,00,00,000</td>
<td>15,60,00,000</td>
</tr>
</tbody>
</table>

© The Institute of Chartered Accountants of India
Quality check and material handling cost *(No longer required in JIT)* | 1,00,00,000 | --- |
--- | --- | --- |
Insurance Cost on raw material inventory *(No longer required in JIT)* | 20,00,000 | --- |
--- | --- | --- |
Warehouse rental for storing raw material *(No longer required in JIT)* | 3,00,00,000 | --- |
--- | --- | --- |
Overtime Charges under JIT to reduce Stockouts *(note 1)* | --- | 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-₹750 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:

(a) 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

<table>
<thead>
<tr>
<th></th>
<th>Mins.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lunch Break</td>
<td>30</td>
</tr>
<tr>
<td>Tea Break</td>
<td>15</td>
</tr>
<tr>
<td>Breakdown, Repair, and Start-up Time (68 mins / 2 Shift)</td>
<td>34</td>
</tr>
<tr>
<td><strong>Total Time Loss Per Shift</strong></td>
<td>79</td>
</tr>
</tbody>
</table>

**Availability Ratio per shift**

\[
\text{Availability Ratio per shift} = \left( \frac{480 \text{ mins.} - 79 \text{ mins.}}{480 \text{ mins.}} \right) \times 100\% \\
= 83.54 \%
\]

**Actual Production**

= 140 tablets *per shift*

**Standard time**

= 2.5 minutes

**Standard Time Required**

= 140 units × 2.5 minutes

= 350 minutes

**Actual Time Taken**

= 480 mins. - 79 mins.

= 401 minutes

**Performance Ratio**

= \left( \frac{350 \text{ mins.}}{401 \text{ mins.}} \right) \times 100\%
= 87.28%

**Quality Ratio**

\[
\frac{140 \text{ tab.} - 25 \text{ tab.}}{140 \text{ tab.}} \times 100\%
\]

= 82.14%

**Thus, OEE**

\[
0.8354 \times 0.8728 \times 0.8214
\]

= 59.89%

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.

(ii) **Availability Ratio per shift**

\[
\frac{210 \text{ hrs.}}{210 \text{ hrs.} + 28 \text{ hrs.}} \times 100\%
\]

= 88.24 %

**Performance Ratio**

\[
\frac{180 \text{ hrs.}}{210 \text{ hrs.}} \times 100\%
\]

= 85.71%
Quality Ratio = \[
\frac{2,520 \text{ units}}{2,800 \text{ units}} \times 100\%
\]
= 90.00%

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 Reduction is the achievement of real and permanent reduction in unit cost of products manufactured.

Realistic savings in cost.

Product’s Utility, Quality and Characteristics are retained.

It is not concerned with maintenance of performance according to standards

Continuous process of critical examination includes analysis and challenge of standards.

Fully dynamic approach.

Universally applicable to all areas of business. Does not depend upon standards, though target amounts may be set.

Emphasis here is partly on present costs and largely on future costs.

The function of Cost Reduction is to find out substitute ways and new means like waste reduction, expense reduction and increased production

Cost reduction is a corrective measure.

---

**Cost Control**

Cost Control involves a comparison of actual with the standards or budgets, to regulate the actual costs.

There could be temporary savings in cost.

Quality Maintenance is not a guarantee.

The process involves setting up a target, investing variances and taking remedial measures to correct them.

Control is achieved through compliance with standards. Standards by themselves are not examined.

Less dynamic than Cost Reduction.

Limited applicability to those items of cost for which standards can be set.

Emphasis on present and past behaviour of costs.

Cost Control does competitive analysis of actual results with established standards.

Cost Control is a preventive measure.

---

**Scope of Cost Reduction**

Some of the important areas where maximum efforts of the organization must concentrate to reduce costs are discussed 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 and 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

Introduction

Advantage

Main Features

Components

Problems

Management Accountant’s Role

Impact on Profitability

Target Costing Data Flow

Most Useful Situations

Control Points

Implementation

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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 Cost Concept

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 target production 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 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. 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:
Value Analysis/Engineering

- 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?
4.10 STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

- 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.

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.
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.

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 form 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;
STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

- 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.

<table>
<thead>
<tr>
<th>Target Costing &amp; Fast-Food Restaurant</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Target Costing &amp; Chemical Production Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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 roadblocks, 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:

<table>
<thead>
<tr>
<th></th>
<th>₹/toy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component H₁</td>
<td>8.50</td>
</tr>
<tr>
<td>Component H₂</td>
<td>7.00</td>
</tr>
<tr>
<td>Labour: 0.40 hr. @ ₹60 per hr.</td>
<td>24.00</td>
</tr>
<tr>
<td>Product Specific Overheads</td>
<td>13.50</td>
</tr>
</tbody>
</table>

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”

<table>
<thead>
<tr>
<th></th>
<th>₹ / Toy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Selling Price</td>
<td>100.00</td>
</tr>
<tr>
<td>Less: Royalty @15%</td>
<td>15.00</td>
</tr>
<tr>
<td>Less: Profit @ 25%</td>
<td>25.00</td>
</tr>
<tr>
<td>Target Cost</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Cost Structure “H”

<table>
<thead>
<tr>
<th></th>
<th>₹ / Toy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component H₁</td>
<td>8.50</td>
</tr>
<tr>
<td>Component H₂</td>
<td>7.00</td>
</tr>
<tr>
<td>Labour (0.40 hr. × ₹ 60 per hr.)</td>
<td>24.00</td>
</tr>
<tr>
<td>Product Specific Overheads</td>
<td>13.50</td>
</tr>
<tr>
<td>Other Material (0.6 kg / 96% × ₹16)</td>
<td>10.00</td>
</tr>
<tr>
<td>Total Cost of Manufacturing</td>
<td>63.00</td>
</tr>
</tbody>
</table>

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.

![Graph of Annual Sales Volume vs. Time showing stages of Product Life Cycle]

**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 nonexistent. The length of the introduction stage differs from product to product depending on various factors.

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Characteristics

<table>
<thead>
<tr>
<th>Decisions about the product branding, packaging and labelling</th>
<th>High distribution and promotional expenses</th>
<th>Profits are low or negative due to low initial volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing may be low-penetration or high-skimming pricing</td>
<td>Huge efforts to attract various marketing channels</td>
<td>Aggressive promotional efforts to increase awareness</td>
</tr>
<tr>
<td>Product refinements are not possible</td>
<td>Few competitors produce basic version of products</td>
<td>Focus on those buyers who are the most ready to buy</td>
</tr>
</tbody>
</table>

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

- Sales of most product forms drop to zero or may remain at a low level
- Profits start declining and at times become negative
- Sales decline for a number of reasons, including technological advances, consumer's shift in taste, etc
- No of organisations producing the products drops

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 file, or left unchanged if it is being liquidated.
- The price may be maintained or reduced drastically if liquidated.

Life Cycle Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Introduction</th>
<th>Growth</th>
<th>Maturity</th>
<th>Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td>Create product awareness &amp; trial</td>
<td>Maximise market share</td>
<td>Maximise profits while defending market share</td>
<td>Reduce expenditures &amp; milk the brand</td>
</tr>
<tr>
<td><strong>Sales</strong></td>
<td>Low sales</td>
<td>Rapidly rising</td>
<td>Peak sales</td>
<td>Declining sales</td>
</tr>
<tr>
<td><strong>Costs per Customer</strong></td>
<td>High cost per customer</td>
<td>Average cost per customer</td>
<td>Low cost per customer</td>
<td>Low cost per customer</td>
</tr>
<tr>
<td><strong>Profits</strong></td>
<td>Negative</td>
<td>Rising profits</td>
<td>High profits</td>
<td>Declining profits</td>
</tr>
<tr>
<td><strong>Customers</strong></td>
<td>Innovators</td>
<td>Early adopters</td>
<td>Middle majority</td>
<td>Laggards</td>
</tr>
<tr>
<td><strong>Competitors</strong></td>
<td>Few</td>
<td>Growing number</td>
<td>Steady number beginning to decline</td>
<td>Declining number</td>
</tr>
</tbody>
</table>

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### Strategies

<table>
<thead>
<tr>
<th></th>
<th>Introduction</th>
<th>Growth</th>
<th>Maturity</th>
<th>Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Offer basic product</td>
<td>Offer product extensions, service &amp; warranty</td>
<td>Diversify brands and models</td>
<td>Phase out weak items</td>
</tr>
<tr>
<td>Price</td>
<td>Cost plus profit</td>
<td>Price to penetrate market</td>
<td>Price to match or beat competitors</td>
<td>Price cutting</td>
</tr>
<tr>
<td>Advertising</td>
<td>Build product awareness amongst early adopters &amp; dealers</td>
<td>Build awareness &amp; interest in mass market</td>
<td>Stress on brand differences and benefits</td>
<td>Reduce level to keep hard core loyalty</td>
</tr>
<tr>
<td>Distribution</td>
<td>Build selective distribution</td>
<td>Build Intensive distribution</td>
<td>Build more intensive distribution</td>
<td>Go selective: Phase out unprofitable outlets</td>
</tr>
<tr>
<td>Sales Promotion</td>
<td>Use heavy sales promotion to entice trial</td>
<td>Reduce to take advantage of heavy consumer demand</td>
<td>Increase to encourage brand switching</td>
<td>Reduce to minimal level</td>
</tr>
</tbody>
</table>

(Source: 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)
STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

- 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-thin tablet 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:

<table>
<thead>
<tr>
<th>Expected Sales</th>
<th>500 units</th>
<th>750 units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale Price</td>
<td>₹ 79,600 per unit</td>
<td>₹ 69,600 per unit</td>
</tr>
<tr>
<td>Variable Selling Costs</td>
<td>10% of Selling Price</td>
<td>10% of Selling Price</td>
</tr>
<tr>
<td>Salvage Value - Plant</td>
<td>₹ 6,25,000</td>
<td>₹ 9,00,000</td>
</tr>
<tr>
<td>Profit Volume Ratio</td>
<td>40%</td>
<td></td>
</tr>
</tbody>
</table>

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”

<table>
<thead>
<tr>
<th>Particulars</th>
<th>₹ / unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>79,600</td>
</tr>
<tr>
<td>Less: Contribution (40%)</td>
<td>31,840</td>
</tr>
<tr>
<td>Variable Cost</td>
<td>47,760</td>
</tr>
<tr>
<td>Less: Variable Selling Costs (₹79,600 × 0.1)</td>
<td>7,960</td>
</tr>
<tr>
<td>Variable Manufacturing Cost</td>
<td>39,800</td>
</tr>
</tbody>
</table>

Statement Showing “Expected Profit”

<table>
<thead>
<tr>
<th>Particulars</th>
<th>₹ / unit (’000)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500 units</td>
</tr>
<tr>
<td>Sales</td>
<td>39,800</td>
</tr>
<tr>
<td>Less: Variable Mfg. Cost</td>
<td>19,900</td>
</tr>
<tr>
<td>Less: Variable Selling Cost</td>
<td>3,980</td>
</tr>
<tr>
<td>Add: Salvage Value</td>
<td>625</td>
</tr>
<tr>
<td>Less: Cost of Plant</td>
<td>3,500</td>
</tr>
<tr>
<td>Net Profit</td>
<td>13,045</td>
</tr>
</tbody>
</table>

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 a 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:

<table>
<thead>
<tr>
<th>Defect</th>
<th>No. of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Frame not equidistant from the centre</td>
<td>10</td>
</tr>
<tr>
<td>Non-uniform grinding of lenses</td>
<td>60</td>
</tr>
<tr>
<td>Power mismatches</td>
<td>20</td>
</tr>
<tr>
<td>Scratches on the surface</td>
<td>110</td>
</tr>
<tr>
<td>Spots / Stains on lenses</td>
<td>5</td>
</tr>
<tr>
<td>Rough edges of lenses</td>
<td>70</td>
</tr>
<tr>
<td>Frame colours-shade differences</td>
<td>25</td>
</tr>
</tbody>
</table>

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”

<table>
<thead>
<tr>
<th>Defect Type</th>
<th>No. of Items</th>
<th>% of Total Items</th>
<th>Cumulative Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratches on the surface</td>
<td>110</td>
<td>36.67%</td>
<td>36.67%</td>
</tr>
<tr>
<td>Rough edges of lenses</td>
<td>70</td>
<td>23.33%</td>
<td>60.00%</td>
</tr>
<tr>
<td>Non-uniform grinding of lenses</td>
<td>60</td>
<td>20.00%</td>
<td>80.00%</td>
</tr>
<tr>
<td>Frame colours-shade differences</td>
<td>25</td>
<td>8.33%</td>
<td>88.33%</td>
</tr>
<tr>
<td>Power mismatches</td>
<td>20</td>
<td>6.67%</td>
<td>95.00%</td>
</tr>
<tr>
<td>End frame not equidistant from the centre</td>
<td>10</td>
<td>3.33%</td>
<td>98.33%</td>
</tr>
<tr>
<td>Spots/ Strain on lenses</td>
<td>5</td>
<td>1.67%</td>
<td>100.00%</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

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]

- Introduction
- Environmental Costs
- Identification of Environmental Costs
- Controlling Environmental Costs
- Reasons for Controlling Environmental Costs
- Role of EMA in Product/Process Related Decision Making
- Advantages/Disadvantages of EMA
- EMA in Practice
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 UNDSD 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,’ (UNDSD, 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 (UNDSD, 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 costs 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 MMTPA 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 theses 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.
4.42 STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

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**

<table>
<thead>
<tr>
<th>Xerox Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>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).</td>
</tr>
</tbody>
</table>
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.

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-
Lifecyle 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:

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Budget</th>
<th>Actual</th>
<th>Actual Cost p.a. (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Material</td>
<td>5,00,000 sq. ft.</td>
<td>5,20,000 sq. ft.</td>
<td>20,00,000</td>
</tr>
<tr>
<td>Direct Labour</td>
<td>90,000 hrs.</td>
<td>1,00,000 hrs.</td>
<td>10,00,000</td>
</tr>
<tr>
<td>Machine Setup</td>
<td>15,000 hrs.</td>
<td>15,000 hrs.</td>
<td>1,50,000</td>
</tr>
<tr>
<td>Mechanical Assembly</td>
<td>200,000 hrs.</td>
<td>200,000 hrs.</td>
<td>30,00,000</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>₹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling Price per unit</td>
<td>50</td>
</tr>
<tr>
<td>Less: Direct Material Cost per unit</td>
<td>9</td>
</tr>
<tr>
<td>Direct Labour Cost per unit</td>
<td>9</td>
</tr>
<tr>
<td>Variable Overhead per unit (3 hrs. @ ₹2)</td>
<td>6</td>
</tr>
<tr>
<td>Contribution per unit</td>
<td>26</td>
</tr>
<tr>
<td>Budgeted Sales Quantity</td>
<td>25,000 units</td>
</tr>
<tr>
<td>Budgeted Contribution (25,000 × ₹26)</td>
<td>6,50,000</td>
</tr>
<tr>
<td>Less: Budgeted Fixed Cost</td>
<td></td>
</tr>
<tr>
<td>Budgeted Profit</td>
<td>1,50,000</td>
</tr>
</tbody>
</table>

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.
STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

**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:

<table>
<thead>
<tr>
<th>Model</th>
<th>Sales (₹’000)</th>
<th>Profit-Volume (PV) Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tab - A001</td>
<td>5,100</td>
<td>3.53%</td>
</tr>
<tr>
<td>Tab - B002</td>
<td>3,000</td>
<td>23.00%</td>
</tr>
<tr>
<td>Tab - C003</td>
<td>2,100</td>
<td>14.29%</td>
</tr>
<tr>
<td>Tab - D004</td>
<td>1,800</td>
<td>14.17%</td>
</tr>
<tr>
<td>Tab - E005</td>
<td>1,050</td>
<td>41.43%</td>
</tr>
<tr>
<td>Tab - F006</td>
<td>750</td>
<td>26.00%</td>
</tr>
<tr>
<td>Tab - G007</td>
<td>450</td>
<td>26.67%</td>
</tr>
<tr>
<td>Tab - H008</td>
<td>225</td>
<td>6.67%</td>
</tr>
<tr>
<td>Tab - I009</td>
<td>75</td>
<td>60.00%</td>
</tr>
</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>Cumulative Sales (units)</th>
<th>Selling Price ₹ per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2,200</td>
<td>750</td>
</tr>
<tr>
<td>2,201 to 7,700</td>
<td>600</td>
</tr>
<tr>
<td>7,701 to 15,950</td>
<td>525</td>
</tr>
<tr>
<td>15,951 to 59,950</td>
<td>450</td>
</tr>
<tr>
<td>59,951 and above</td>
<td>300</td>
</tr>
</tbody>
</table>
Based on these selling prices, it is expected that sales demand will be as shown below:

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Sales Demand per week (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>220</td>
</tr>
<tr>
<td>11-20</td>
<td>550</td>
</tr>
<tr>
<td>21-30</td>
<td>825</td>
</tr>
<tr>
<td>31-70</td>
<td>1,100</td>
</tr>
<tr>
<td>71-80</td>
<td>880</td>
</tr>
<tr>
<td>81-90</td>
<td>660</td>
</tr>
<tr>
<td>91-100</td>
<td>440</td>
</tr>
<tr>
<td>101-110</td>
<td>220</td>
</tr>
<tr>
<td>Thereafter</td>
<td>NIL</td>
</tr>
</tbody>
</table>

Unit variable costs are expected to be as follows:

<table>
<thead>
<tr>
<th></th>
<th>₹ per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 2,200 units</td>
<td>375</td>
</tr>
<tr>
<td>Next 13,750 units</td>
<td>300</td>
</tr>
<tr>
<td>Next 22,000 units</td>
<td>225</td>
</tr>
<tr>
<td>Next 22,000 units</td>
<td>188</td>
</tr>
<tr>
<td>Thereafter</td>
<td>225</td>
</tr>
</tbody>
</table>

PGIL uses just-in-time production system. Following is the total contribution statement of the product ‘α3’ for its Introduction and Growth stage:

<table>
<thead>
<tr>
<th></th>
<th>Introduction</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeks</td>
<td>1 - 10</td>
<td>11 - 30</td>
</tr>
<tr>
<td>Number of units Produced and Sold</td>
<td>2,200</td>
<td>5,500</td>
</tr>
<tr>
<td>Selling Price per unit (₹)</td>
<td>750</td>
<td>600</td>
</tr>
<tr>
<td>Variable Cost per unit (₹)</td>
<td>375</td>
<td>300</td>
</tr>
<tr>
<td>Contribution per unit (₹)</td>
<td>375</td>
<td>300</td>
</tr>
<tr>
<td>Total Contribution (₹)</td>
<td>8,25,000</td>
<td>16,50,000</td>
</tr>
</tbody>
</table>
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.

JFE, is following Life Cycle Costing. Its four products \( P_4, P_3, P_2 \) and \( P_1 \) 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 \([ (1 + 2) \times 4 ]\) 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).

<table>
<thead>
<tr>
<th>Products (1)</th>
<th>Phases (Stages) (2)</th>
<th>Characteristics (3)</th>
<th>Strategies (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₄</td>
<td>Introduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₃</td>
<td>Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₂</td>
<td>Maturity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁</td>
<td>Decline</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(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:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Direct Material (per kg of fertilizer produced)</td>
<td>₹90</td>
<td>₹120</td>
<td>₹90</td>
<td>₹300</td>
</tr>
<tr>
<td>Cost of Direct Labour (per kg of fertilizer produced)</td>
<td>₹60</td>
<td>₹80</td>
<td>₹60</td>
<td>₹200</td>
</tr>
<tr>
<td>Cost Allocation to Grade A</td>
<td>30%</td>
<td>50%</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Cost Allocation to Grade B</td>
<td>70%</td>
<td>50%</td>
<td>70%</td>
<td></td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Waste produced (in tonnes per annum)</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Grade B</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>9</td>
</tr>
</tbody>
</table>

Based on 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:

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Units</th>
<th>Actual Cost p.a. for 10,000 racks (₹)</th>
<th>Actual Cost per rack (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>10,000 racks</td>
<td>75,00,000</td>
<td>750</td>
</tr>
<tr>
<td>Direct Material</td>
<td>5,20,000 sq. ft.</td>
<td>20,00,000</td>
<td>200</td>
</tr>
<tr>
<td>Direct Labour</td>
<td>1,00,000 hrs.</td>
<td>10,00,000</td>
<td>100</td>
</tr>
<tr>
<td>Machine Setup</td>
<td>15,000 hrs.</td>
<td>1,50,000</td>
<td>15</td>
</tr>
<tr>
<td>Mechanical Assembly</td>
<td>200,000 hrs.</td>
<td>30,00,000</td>
<td>300</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td>61,50,000</td>
<td>615</td>
</tr>
<tr>
<td><strong>Profit</strong></td>
<td></td>
<td>13,50,000</td>
<td>135</td>
</tr>
</tbody>
</table>

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?
4. 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 when the product quality, characteristics and utility are maintained.

2. (i) Target Production Time per unit

   \[
   (\text{\textpenalty10000 ₹3 + ₹3 + ₹2}) \times \text{hrs.} \times 30,000 \text{ units} = 5,10,000 \\
   \text{Hrs.} = 2.125 \\
   \text{Time to be reduced per unit} = 3 \text{ hrs.} - 2.125 \text{ hrs.} = 0.875 \text{ hrs.}
   \]

**Workings**

**Statement Showing Target Cost (Direct Labour and Variable Overhead)**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Amount (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Sales (₹55 × 30,000 units)</td>
<td>16,50,000</td>
</tr>
<tr>
<td>Less: Target Profit</td>
<td>3,00,000</td>
</tr>
<tr>
<td>Less: Direct Material Cost (₹9 × 30,000 units)</td>
<td>2,70,000</td>
</tr>
<tr>
<td>Less: Budgeted Fixed Costs</td>
<td>5,00,000</td>
</tr>
<tr>
<td>Less: Proposed Advertising</td>
<td>40,000</td>
</tr>
<tr>
<td>Less: Proposed Annual Group Bonus</td>
<td>30,000</td>
</tr>
<tr>
<td>Target Cost (Variable Overhead and Direct Labour) for 30,000 units</td>
<td>5,10,000</td>
</tr>
</tbody>
</table>

(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”

<table>
<thead>
<tr>
<th>Model</th>
<th>Sales (₹’000)</th>
<th>% of Total Sales</th>
<th>Cumulative Total</th>
<th>Model</th>
<th>Cont. (₹’000)</th>
<th>% of Total Cont.</th>
<th>Cumulative Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A001</td>
<td>5,100</td>
<td>35.05%</td>
<td>35.05%</td>
<td>B002</td>
<td>690</td>
<td>30.87%</td>
<td>30.87%</td>
</tr>
<tr>
<td>B002</td>
<td>3,000</td>
<td>20.62%</td>
<td>55.67%</td>
<td>E005</td>
<td>435</td>
<td>19.47%*</td>
<td>50.34%</td>
</tr>
<tr>
<td>C003</td>
<td>2,100</td>
<td>14.43%</td>
<td>70.10%</td>
<td>C003</td>
<td>300</td>
<td>13.42%</td>
<td>63.76%</td>
</tr>
<tr>
<td>D004</td>
<td>1,800</td>
<td>12.37%</td>
<td>82.47%</td>
<td>D004</td>
<td>255</td>
<td>11.41%</td>
<td>75.17%</td>
</tr>
<tr>
<td>E005</td>
<td>1,050</td>
<td>7.22%</td>
<td>89.69%</td>
<td>F006</td>
<td>195</td>
<td>8.73%*</td>
<td>83.90%</td>
</tr>
<tr>
<td>F006</td>
<td>750</td>
<td>5.15%</td>
<td>94.84%</td>
<td>A001</td>
<td>180</td>
<td>8.05%</td>
<td>91.95%</td>
</tr>
<tr>
<td>G007</td>
<td>450</td>
<td>3.09%</td>
<td>97.93%</td>
<td>G007</td>
<td>120</td>
<td>5.37%</td>
<td>97.32%</td>
</tr>
<tr>
<td>H008</td>
<td>225</td>
<td>1.55%</td>
<td>99.48%</td>
<td>I009</td>
<td>45</td>
<td>2.01%</td>
<td>99.33%</td>
</tr>
<tr>
<td>I009</td>
<td>75</td>
<td>0.52%</td>
<td>100.00%</td>
<td>H008</td>
<td>15</td>
<td>0.67%</td>
<td>100.00%</td>
</tr>
<tr>
<td></td>
<td>14,550</td>
<td>100.00%</td>
<td></td>
<td></td>
<td>2,235</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

(*) Rounding - off difference adjusted.
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”

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Maturity</th>
<th>Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeks</td>
<td>31 - 50</td>
<td>51 - 70</td>
</tr>
<tr>
<td>Number of units Produced and Sold</td>
<td>22,000</td>
<td>22,000</td>
</tr>
<tr>
<td>Selling Price per unit (₹)</td>
<td>450</td>
<td>450</td>
</tr>
<tr>
<td>Less: Unit Variable Cost (₹)</td>
<td>225</td>
<td>188</td>
</tr>
<tr>
<td>Unit Contribution (₹)</td>
<td>225</td>
<td>262</td>
</tr>
<tr>
<td>Total Contribution (₹)</td>
<td>49,50,000</td>
<td>57,64,000</td>
</tr>
</tbody>
</table>

(ii) **Pricing Strategy for Product α³**

PGIL is following the skimming price strategy that’s why it has planned to launch the product α³ 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 $\alpha^3$ 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 ‘$\alpha^3$’**

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 $\alpha^3$ 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 $\alpha^3$ 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 $\alpha^3$ 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**

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Demand per week</th>
<th>Total Sales</th>
<th>Cumulative Sales</th>
<th>Selling Price per unit (₹)</th>
<th>Variable Cost per unit (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 10</td>
<td>220</td>
<td>2,200</td>
<td>2,200</td>
<td>750</td>
<td>375</td>
</tr>
<tr>
<td>11 - 20</td>
<td>550</td>
<td>5,500</td>
<td>7,700</td>
<td>600</td>
<td>300</td>
</tr>
<tr>
<td>21 - 30</td>
<td>825</td>
<td>8,250</td>
<td>15,950</td>
<td>525</td>
<td>300</td>
</tr>
<tr>
<td>31 - 50</td>
<td>1,100</td>
<td>22,000</td>
<td>37,950</td>
<td>450</td>
<td>225</td>
</tr>
<tr>
<td>51 - 70</td>
<td>1,100</td>
<td>22,000</td>
<td>59,950</td>
<td>450</td>
<td>188</td>
</tr>
<tr>
<td>71 - 80</td>
<td>880</td>
<td>8,800</td>
<td>68,750</td>
<td>300</td>
<td>225</td>
</tr>
</tbody>
</table>
COST MANAGEMENT TECHNIQUES

5. (i) Statement Showing Product Life Cycle Characteristics and Strategies

<table>
<thead>
<tr>
<th>Products (1)</th>
<th>Phases (Stages) (2)</th>
<th>Characteristics (3)</th>
<th>Strategies (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₄</td>
<td>Introduction</td>
<td>(3)</td>
<td>(5), (11)</td>
</tr>
<tr>
<td>P₃</td>
<td>Growth</td>
<td>(6)</td>
<td>(10), (8)</td>
</tr>
<tr>
<td>P₂</td>
<td>Maturity</td>
<td>(1)</td>
<td>(4), (12)</td>
</tr>
<tr>
<td>P₁</td>
<td>Decline</td>
<td>(9)</td>
<td>(2), (7)</td>
</tr>
</tbody>
</table>

(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)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Grade A</th>
<th>Grade B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling Price</td>
<td>280</td>
<td>400</td>
<td>680</td>
</tr>
<tr>
<td>Direct Material (Refer Table 1)</td>
<td>114</td>
<td>186</td>
<td>300</td>
</tr>
<tr>
<td>Direct Labour (Refer Table 1)</td>
<td>76</td>
<td>124</td>
<td>200</td>
</tr>
<tr>
<td>Overheads (allocated equally)</td>
<td>75</td>
<td>75</td>
<td>150</td>
</tr>
<tr>
<td>Total Expenses</td>
<td>265</td>
<td>385</td>
<td>650</td>
</tr>
<tr>
<td>Profit</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Profitability</td>
<td>5.36%</td>
<td>3.75%</td>
<td>×</td>
</tr>
</tbody>
</table>

Table 1 Allocation of Direct Materials and Labour as per Cost Centre and Product

<table>
<thead>
<tr>
<th>Particulars</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>Total for the company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>CC Total</td>
<td>A</td>
</tr>
<tr>
<td>Direct Material</td>
<td>27</td>
<td>63</td>
<td>90</td>
<td>60</td>
</tr>
<tr>
<td>Direct Labour</td>
<td>18</td>
<td>42</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Grade A</th>
<th>Grade B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling Price</td>
<td>280</td>
<td>400</td>
<td>680</td>
</tr>
<tr>
<td>Less: Direct Material (refer table 1)</td>
<td>114</td>
<td>186</td>
<td>300</td>
</tr>
<tr>
<td>Less: Direct Labour (refer table 1)</td>
<td>76</td>
<td>124</td>
<td>200</td>
</tr>
<tr>
<td>Less: Overheads (refer table 2)</td>
<td>66</td>
<td>84</td>
<td>150</td>
</tr>
<tr>
<td>Profit</td>
<td>24</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Profitability</td>
<td>8.57%</td>
<td>1.50%</td>
<td>×</td>
</tr>
</tbody>
</table>

Table 2 Allocation of Overhead Expenses to each Cost Centre and Product

(Figures in ₹ per kilogram of fertilizer produced)

<table>
<thead>
<tr>
<th>Product Waste Produced (in tonnes per annum)</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Grade B</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Total Waste (in tonnes)</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Incinerator Cost Allocated to Cost Centres</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>90</td>
</tr>
<tr>
<td>(based on waste generated)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Overhead Expenses</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Total Cost Centre Wise Overhead Cost</td>
<td>44</td>
<td>50</td>
<td>56</td>
<td>150</td>
</tr>
</tbody>
</table>
### Part A: Allocation of Incinerator Cost

*from Cost Centre to each product (based on waste produced at each cost centre by each product)*

<table>
<thead>
<tr>
<th>Product</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td>12</td>
<td>18</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>Grade B</td>
<td>12</td>
<td>12</td>
<td>30</td>
<td>54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>90</td>
</tr>
</tbody>
</table>

### Part B: Allocation of Other Overhead Cost

*from Cost Centre to each product*

<table>
<thead>
<tr>
<th>Product</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Grade B</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>60</td>
</tr>
</tbody>
</table>

### Part C: Total Overhead Cost

*(Cost Centre and Product Wise i.e. part a + b)*

<table>
<thead>
<tr>
<th>Product</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td>22</td>
<td>28</td>
<td>16</td>
<td>66</td>
</tr>
<tr>
<td>Grade B</td>
<td>22</td>
<td>22</td>
<td>40</td>
<td>84</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>44</td>
<td>50</td>
<td>56</td>
<td>150</td>
</tr>
</tbody>
</table>

### Summarizing Product Profitability

*as per both methods:

<table>
<thead>
<tr>
<th>Product</th>
<th>(Profit in ₹ per kg of fertilizer produced)</th>
<th>Profit %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Original Method</td>
<td>ABC (as per EMA Method)</td>
</tr>
<tr>
<td>Grade A</td>
<td>15 (5.36%)</td>
<td>24 (8.57%)</td>
</tr>
<tr>
<td>Grade B</td>
<td>15 (3.75%)</td>
<td>6 (1.50%)</td>
</tr>
</tbody>
</table>

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

- Key Risks
- A Complex Network
- Features
- Application of Cost Management Techniques
- Value Chain Analysis

Agriculture Sector

- Features
- Cost Management

Information Technology (IT) Sector

- Engagement Model
- Cost Optimization Framework

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, naptha, 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.

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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 Analysis

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.
5.4 STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

**Generation & Trading**
- Virtual Power Plants
- Remote Monitoring and Control of Decentralised Generation
- Digital Supply Chain
- Realtime Energy Trading/ Straight through Processing

**Transmission**
- Condition Monitoring
- Grid Stability Based Management of Renewable Generation

**Distribution and Metering**
- Smart Metering and Variable Energy Tariffs
- Smart Grids
- Condition Based Maintenance
- Digital/ Mobile Workforce

**Storage**
- Integration of Decentralised Storage Facilities

**Marketing, Sales & Service**
- Self Service Portals
- Social Media Marketing
- App Based Mobile Service
- Analytics Based Customer Segmentation and Pricing
- Performance Marketing

**Customer**
- Smart Home
- Demand Response Management
- Cross Energy Management/ Data Mining Based Energy Efficiency Analysis

References:
1. Annual Report, Reliance Power Ltd.;
2. https://www.eia.gov;

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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 the 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.