



COST MANAGEMENT TECHNIQUES



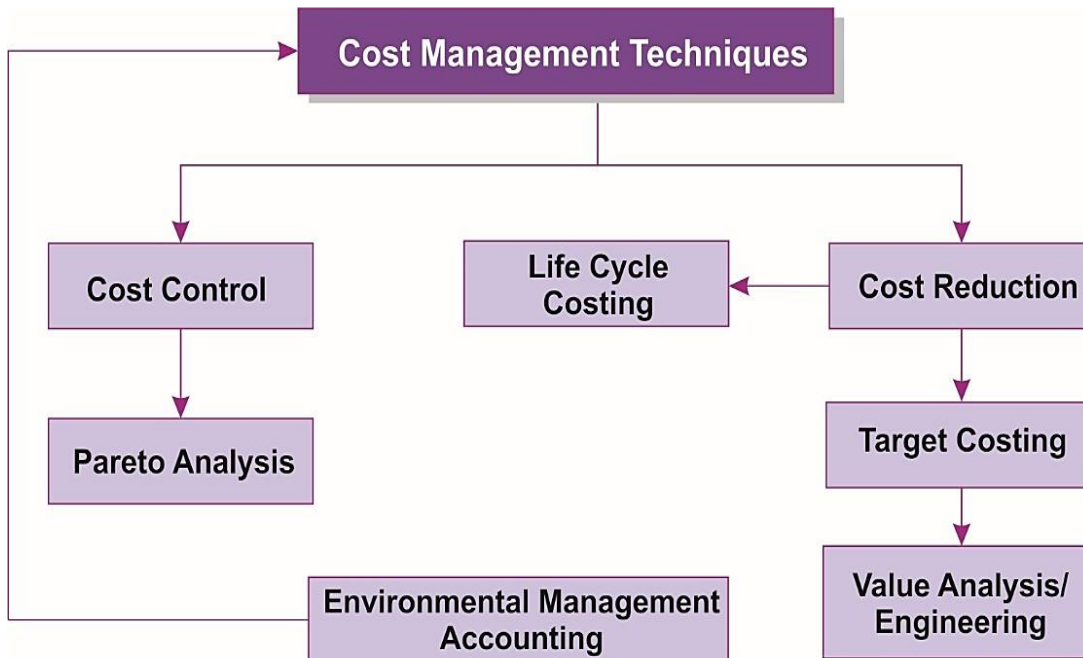
LEARNING OUTCOMES

After studying this chapter, you will be able to:

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



CHAPTER OVERVIEW



COST CONTROL/ WASTE CONTROL AND COST REDUCTION

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

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

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

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

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

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

Scope of Cost Reduction

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

Product Design

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

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

Organisation

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

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

Factory Lay Out Equipment

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

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

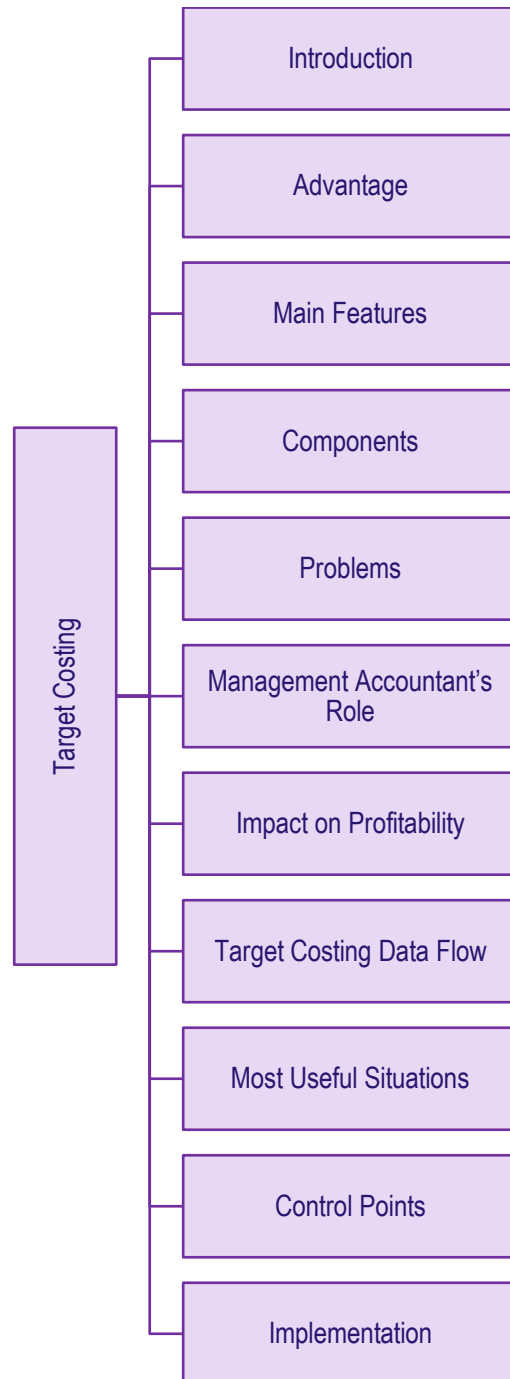
Production Plan Programme and Method

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

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

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

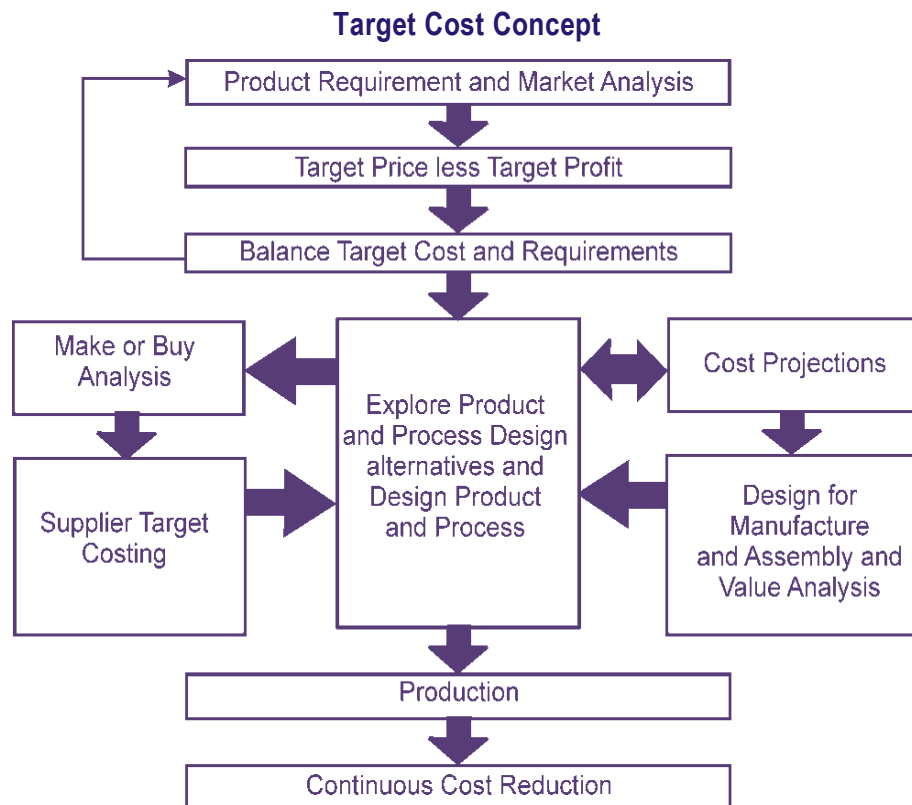
Tools and Techniques for Cost Reduction are Value Analysis, Inventory Management (Just in Time etc.), Business Process Reengineering (BPR), Target Costing, Kaizen Costing etc.

 TARGET COSTING

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

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

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



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

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

Advantages of Target Costing

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

Main features of Target Costing System

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

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

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

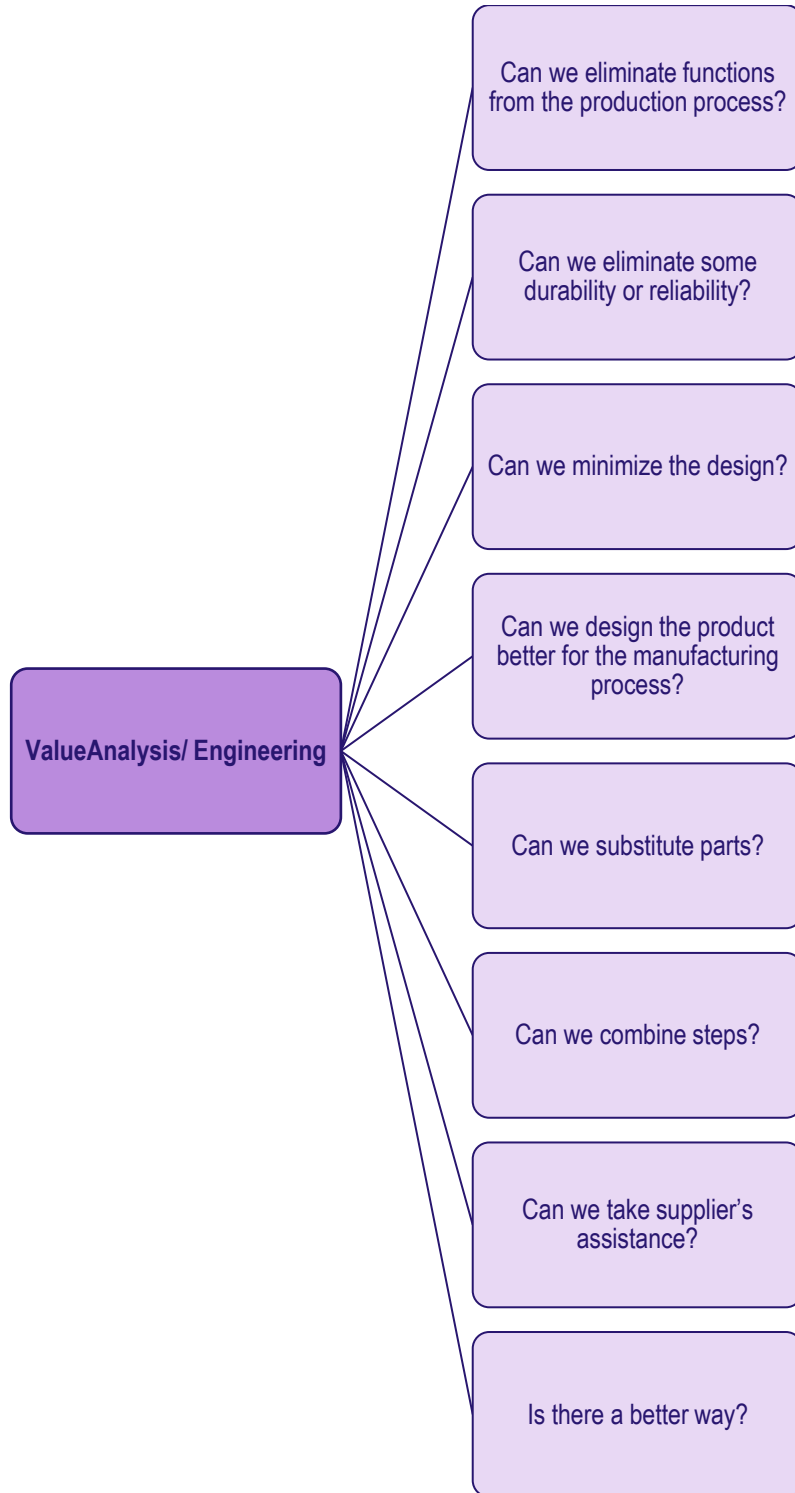
- Integral to setting the *target selling price is the establishment of target production volumes, given the relationship between price and volume*. The expected target volumes are also critical to computing unit costs, especially with respect to capacity-related costs (such as tooling costs), as product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

Components of Target Costing System

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

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

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



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

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

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

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

- **Can we minimize the design?**

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

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

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

- **Can we substitute parts?**

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

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

- **Can we combine steps?**

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

- **Can we take supplier's assistance?**

Another approach to value engineering is to call on the services of a company's suppliers to assist in the cost reduction effort. These organizations are particularly suited to contribute information concerning enhanced types of technology of materials, since they may specialize in areas that a company has no information about. They may have also conducted extensive value engineering for the components they manufacture, resulting in advanced designs that a company may be able to incorporate into its new products. Suppliers may have also redesigned their production processes, or can be assisted by a company's engineers in doing so, producing cost reductions or decreased production waste that can be translated into lower component costs for the company.

- **Is there a better way?**

Though this step sounds rather vague, it really strikes at the core of the cost reduction issue—the other value engineering steps previously mentioned focus on incremental improvements to the existing design or production process, whereas this one is a more general attempt to start from scratch and build a new product or process that is not based in any way on preexisting ideas. Improvements resulting from this step lend to have the largest favourable impact on cost reductions but can also be the most difficult for the organization to adopt, especially if it has used other designs or systems for the production of earlier models.

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A mix of all the value engineering steps noted above must be applied to each product design to ensure that the maximum permissible cost is safely reached. Also, even if a minimal amount of value engineering is needed to reach a cost goal, one should conduct the full range of value engineering analysis anyway, since this can result in further cost reductions that improve the margin of the product or allow management the option of reducing the product's price, thereby creating a problem for competitors who sell higher-priced products.

The initial value engineering may not uncover all possible cost savings. Thus, **Kaizen Costing** is designed to repeat many of the value engineering steps for as long as a product is produced, constantly refining the process and thereby stripping out extra costs (already discussed in Chapter-3). The cost reductions resulting from kaizen costing are much smaller than those achieved with value engineering but are still worth the effort since competitive pressures are likely to force down the price of a product over time, and any possible cost savings allow a company to still attain its targeted profit margins while continuing to reduce cost.

The type of cost reduction program used for target costing has an impact on the extent of cost reduction, as well as on the nature of the components used in a product. When a design team elects to set cost reduction goals by allocating specific cost reduction amounts to major components of an existing product, it tends to focus on finding ways to make incremental cost reductions rather than focusing on entirely new product configurations that might both radically alter the product's design and lower its cost. This approach is most commonly used during the redesign of products already in the market. Another cost reduction approach is to allocate cost reductions based on the presence of certain product features in a product design. This method focuses the attention of the design team away from using the same components that were used in the past, which tends to produce more radical design changes that yield greater cost savings. However, the latter approach is also a riskier one, since the resulting product concepts may not work, and also requires so much extra design work that the new design may not be completed for a long time. Therefore, the second method is generally reserved for situations where a company is trying to create products at a radically lower cost than previously.

Further, *Target Costing System is based on involving representatives of all the Value Chain such as suppliers, agents, distributors and existing after-sales service in the target costing system. This aim to spread concepts and efforts to reduce the cost over all the value chain through the development of the spirit co-operation and understanding among all members of organizations associated with the product from suppliers, producers, customers, agents and service providers. The target costing system is based on the concept of long-term relations and mutual benefits in the long term between suppliers and all members of representatives of all the value chain².*

All the changes noted in this section that are necessary for the implementation and use of the target costing methodology represent a massive change in mind-set for the product design personnel of any company because they require the constant cooperation of many departments and rapid, voluminous communications between them. All these concepts run counter to the traditional approach.

(Source: 1. Value Analysis, Functional Analysis, Value Engineering and Target Costing by Norwood Whittle; 2. The Relationship between Target Costing and Competitive Advantage, International Journal of Business and Management Vol. 7, No. 8; April 2012)

Case Scenario

Queenstown Wood Co. (QWC) began 20 years ago, as a small family-run business supplying custom-made school furniture. Now QWC has grown into a thriving hub of experts specializing in either custom-made, locally sourced or quality imported commercial grade furniture. The newly appointed CFO is concerned about the trends in dropping sales volumes, increasing costs, and hence falling profits over the last three years. He observed that the reason of these trends is increased cut-throat competition that has emerged over the last three years. For many years, QWC has been known for high quality but now this quality is being matched by the competitors. QWC's share of the market is declining due to equivalent products being sold by competitors at lower prices. It is considered that, to offer such low prices, the furniture's production costs of the competitors must be lower than QWC's.

Required

ADVISE how QWC can improve its sales volumes, costs and profits using Value Analysis and Functional Analysis.

Solution

Value Analysis is viewed as a reduction in cost and problem solving technique. Such technique analyses an *existing product* to identify and cutback or eliminate any cost which do not give any contribution to performance or value. It is a planned, scientific approach to cost reduction which reviews the *material composition* of a product and *production design* so that modifications and improvements can be made which do not reduce the value of the product to the customer or to the user. (i.e. quality for purpose should not be compromised.)

Functional analysis is applied to the design of *new products* and breaks the product down into functional parts. For example, a new chair may have the moveable feature. The value that the customer places on each feature is considered and added to give a target cost. Thus, functional analysis aims to increase profits by reducing costs through elimination of *unnecessary features* and/or by adding cost-effective *new features* that are so *attractive to customers* that the product becomes more lucrative.

The result of the above analysis is to improve the value of the furniture while maintaining costs and/or cutback the costs of the furniture without compromising with value. It is clear from the scenario that QWC needs to cut back its selling prices to compete in the market. This selling price reduction can only be possible by a reduction in QWC's unit costs; however, such reduction must not be accomplished by compromising with quality. Both value analysis and functional cost analysis may be used for QWC; however, value analysis is likely to be a more useful technique because office tables and chairs are such items which are demanded more on the basis of their use value rather than their esteem value.

Problems with Target Costing

Though the target costing system results in clear, substantial benefits in most cases, it has a few problems that one should be aware of and guard against. These problems are as follows:

- *The development process can be lengthened to a considerable extent* since the design team may require a number of design iterations before it can devise a sufficiently low-cost product that meets the target cost and margin criteria. This occurrence is most common when the project manager is unwilling to “pull the plug” on a design project that cannot meet its costing goals within a reasonable time frame. Usually, if there is no evidence of rapid progress toward a specific target cost within a relatively short period of time, it is better to either ditch a project or at least shelve it for a short time and then try again, on the assumption that new cost reduction methods or less expensive materials will be available in the near future that will make the target cost an achievable one.
- A large amount of mandatory cost cutting can *result in finger-pointing in various parts of the company*; especially if employees in one area feel they are being called on to provide a disproportionately large part of the savings. For example, the industrial engineering staff will not be happy if it is required to completely alter the production layout in order to generate cost savings, while the purchase staff is not required to make any cost reductions through supplier negotiations. Avoiding this problem requires strong interpersonal and negotiation skills on the part of the project manager.
- Representatives from number of departments on the design team can sometimes make it more *difficult to reach a consensus on the proper design* because there are too many opinions regarding design issues. This is a major problem when there are particularly stubborn people on the design team who are holding out for specific product features. Resolving out is difficult and requires a strong team manager, as well as a long-term commitment on the part of a company to weed out those who are not willing to act in the best interests of the team.
- Effective implementation and use *requires the development of detailed cost data*. This can be really costly and may not be profitable for the company when a detailed cost-benefit analysis is done.
- Use of target costing *may reduce the quality of products* due to the use of cheap components which may be of inferior quality.
- For every problem area outlined have the dominant solution is retaining strong control over the design teams, which calls for a good team leader. This person must have an exceptional knowledge of the design process, good interpersonal skills, and a commitment to staying within both time and cost budgets for a design project.

Management Accountant's Role in a Target Costing Environment

- The management accountant should be able to *provide for the other members of the design team a running series of cost estimates based on initial designs sketch*, activities based costing reviews of production processes, and “best guess” costing information from suppliers based on estimated production volumes. Essentially in the earliest stages of a design, accountant works

with vague costing information and so must be able to provide estimates within a high-low range costs, gradually tightening this estimated cost range as more information becomes available.

- The management accountant should also be *responsible for any capital budgeting* requests generated by the design team since he or she has the knowledge of the capital budgeting process, how to fill out the required forms, and precisely what types of equipment are needed for the anticipated product design. The management accountant also becomes the key contact on the design team for answers to any questions from the finance staff regarding issues or uncertainties in the capital budgeting proposal.
- The management accountant should work with the design team to help it understand the nature of various costs (such as cost allocations based on an activity-based costing system), as well as the *cost-benefit trade-offs of using different design or cost operations* in the new product.
- In addition, the management accountant is *responsible for tracking the gap between the current cost of a product design and the target cost* that is the design team's goal, providing an itemization of where cost savings have already been achieved and where there has not been a sufficient degree of progress.
- Finally, the management accountant must continue to *compare a product's actual cost to the target cost after the design is completed*, and for as long as the company sells the product. This is a necessary step because management must know immediately if costs are increasing beyond budgeted levels and why these increases are occurring.

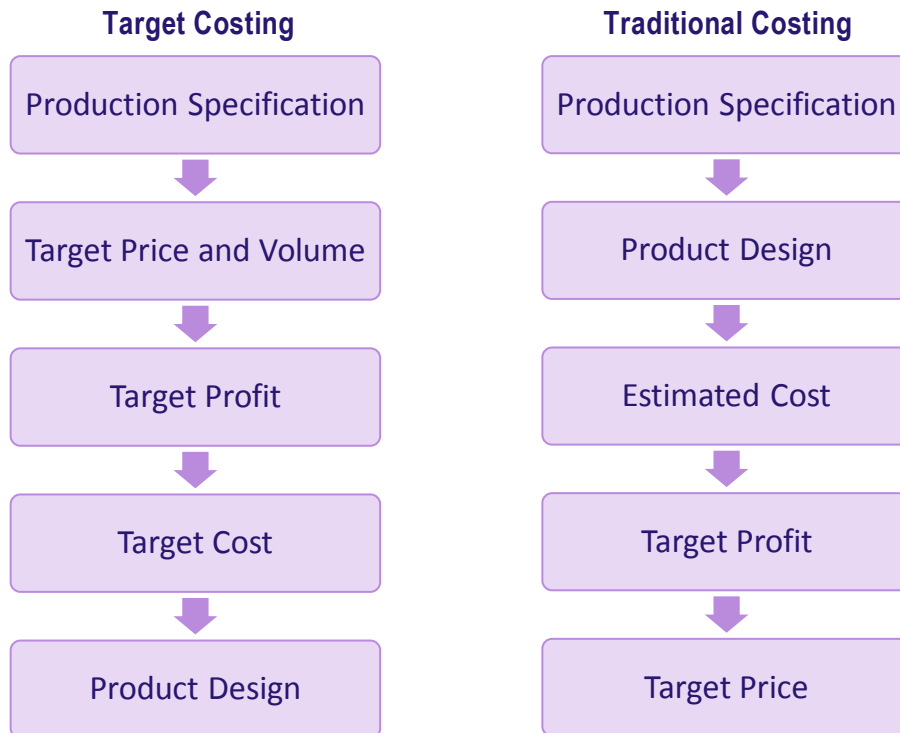
There are particular qualifications that a management accountant must have to be assigned to a target costing team. Certainly, one is having a good knowledge of company products as well as their features and components. Also, the management accountant must know how to create an activity based costing system to evaluate related production costs, or at least interpret such costing data developed by someone else. Further, he or she must work well in a team environment, proactively assisting other members of the team in constantly evaluating the costs of new design concepts. In addition, he or she should have good analytical and presentation skills, since the ongoing costing results must be continually presented not only to other members of the team but also to the members of the milestone review committee. Thus, the best management accountant for this position is an outgoing person with several years of experience within a company or industry.

Impact of Target Costing on Profitability

Target costing can have a startlingly large positive impact on profitability, depending on the commitment of management to its use, the constant involvement of management accountants in all stages of a product's life cycle, and the type of strategy a company follows. Target costing improves profitability in two ways.

- It places such a detailed *continuing emphasis on product costs throughout the life cycle* of every product that it is unlikely that a company will experience runaway costs; also, the management team is completely aware of costing issues since it receives regular reports from the management accounting members of all design teams.
- It improves profitability through *precise targeting of the correct prices* at which the company feels it can field a profitable product in the marketplace that will sell in a robust manner. This is opposed

to the more common cost-plus approach under which a company builds a product, determines its cost, tacks on a profit and then does not understand why its resoundingly high price does not attract buyers. Thus, target costing results not only in better cost control but also in better price control.



A company's strategy can also have its impact on profitability. If it constantly issues a stream of new products, or if its existing product lines is subject to severe pricing pressure, it *must make target costing a central part of its strategy* so that the correct price points are used for products and actual costs match those originally planned. However, there are other strategies, such as growth by geographical expansion of the current product line (as is practiced by retail stores) or growth by acquisition, where there is no particular need for target costing—these companies make their money in other ways than by a focused concentration on product features and costs.

If the issues presented here are properly dealt with by a management team, it should find that target costing is one of the best accounting methods available for improving profitability. It is indeed one of the most pro-active systems found in the entire range of accounting knowledge.

Target Costing Data Flow

- Data can be obtained from *central accounting data base* carefully stocked from such a variety of sources as accounts payable, billing, bills of materials and inventory records.

- In initial stages of product design, the cost accountant must make the best possible *guesses regarding the cost of proposed designs*.
- The cost accountant may include the *best estimate an additional estimate of the highest possible cost* that will be encountered. This additional information lets management know whether there is a significant degree of risk that the project may not achieve its desired cost target.
- Data can also be obtained from *competitor's information collected by the marketing staff or an outside research agency*. This database contains information about the prices at which competitors are selling their products, as well as the prices of ancillary products and perhaps also the discounts given at various price points. It can also include market share data for individual products or by firm, the opinion of customers regarding the offerings of various companies, and the financial condition of competitors. This information is mostly used to determine the range of price points at which a company should sell its existing or anticipated products,
- Sometimes information is compiled by a combined effort of the marketing and engineering staffs through a process called *reverse engineering*. This source can also serve as a data base for the project team.
- Engineering staff also compiles their own cost data relating to different designs/components. This *data is collected over the years* and can be useful for target costing.
- The final database available to the cost accounting member of a design team contains information regarding the previous quality, cost and on-time delivery performance of all key suppliers, as well as the production capacity of each one.

Most Useful Situations for Target Costing

Target costing is most useful in situations where the majority of product costs are locked in during the product design phase. This is the case for most manufactured products, but few services. In the services area, such as consulting, the bulk of all activities can be reconfigured for cost reduction during the “production” phase, which is when services are being provided directly to the customer. In the services environment, the “design team” is still present but is more commonly concerned with streamlining the activities conducted by the employees providing the service, which can continue to be enhanced at any time, not just when the initial services process is being laid out.

Whenever a new and innovative approach to doing business is discovered, the question arises as to which clients and potential clients might this methodology provide an appropriate fit. In addition, and consistent with many new financial or operational approaches, target costing may not be for everyone. Some companies, which seem to benefit most from target costing, are those, which maintain the following criteria:

- Assembly-oriented industries, as opposed to repetitive-process industries that produce homogeneous products;
- Involved heavily with the diversification of the product lines;

- Use technologies of factory automation, including computer-aided design, flexible manufacturing systems, office automation, and computer-aided manufacturing;
- Have experienced shorter product life cycles where the pay-back for factory automation typically must be achieved in less than eight years;
- Must develop systems for reducing costs during the planning, design and development phases of a product's life cycle;
- Are implementing management methods such as just-in-time, value engineering.

The above listing is not completely exhaustive as a variety of factors are at work to promote the usefulness of target costing in other companies.

Target Costing & Fast-Food Restaurant

Design team can lay out the floor plan of a fast-food restaurant, with the objective of creating an arrangement that allows employees to cover the shortest possible distances while preparing food and serving customers; this is similar to the design of a new product. However, unlike a product design, this layout can be readily altered at any time if the design team can arrive at a better layout, so that the restaurant staff can continue to experience high levels of productivity improvement even after the initial design and layout of the facility. In this situation costs are not locked in during the design phase, so there is less need for target costing.

Target Costing & Chemical Production Industry

Another situation where target costing results in less value is the production of raw materials, such as chemicals. In this case, there are no design features; instead, the industrial engineering staff tries to create the most efficient possible production process, which has little to do with cost reduction through the improvement of customer value.

Target Costing Control Points

Control Points which should be taken care of in all target costing projects:

- **Identification of Principal Control Point:** Experience shows that there always comes a point, where the cost of maintaining the design team exceeds the savings garnered from additional iterations. It is also necessary that most products should be launched within a reasonably short time or they will miss the appropriate market, where they will beat the delivery of competing products to the market. This emphasis that the principal control points over the course of target costing programme should be properly taken care of.
- **Point of Go/No Go Decision:** If target costing is not reached, management retains power to abandon the design project. There comes a point, when actual performance is very close to expected performance in matter of cost incurrence.
- **Milestone can be in terms of Timer or Points:** A milestone can be in terms of time, say one month. It can also be on the points in design process, at which specific activities are completed.

Implementing a Target Costing System

A target costing initiative requires the participation of several departments. Because there are so many participants in the process from so many departments, some of whom have different agendas in regard to what they want the program to produce. Design projects can be delayed by squabbling or by an inability to drive down design or production costs in a reasonably efficient manner. This delay may lead to serious cost overruns in the cost of the design team itself, which can lead to abrupt termination of the entire target costing system by the management team. However, these problems can be mitigated or completely eliminated by ensuring that the steps listed here are completed when the target costing system is first installed:

- **Create a Project Charter:** The target costing effort should begin with a document, approved by senior management that describes its goals and what it is authorized to do. This document, known as the project charter, is essentially a subset of the corporate mission statement and related goals as they pertain to the target costing initiative. Written approval of this document by the senior management group provides the target costing effort with a strong basis of support and direction in all subsequent efforts.
- **Obtain a Management Sponsor:** The next step is to obtain the strongest possible support from a management sponsor. This should be an individual who is well positioned near the top of the corporate hierarchy, believes strongly in the goals of target costing, and will support the initiative in all respects—obtaining funding, lobbying other members of top management, working to eliminate road blocks, and ensuring that other problems are overcome in timely manner. This person is central to the success of target costing.
- **Obtain a Budget:** The target costing program requires funds to ensure that one or more well-staffed design teams can complete target costing tasks. The funding should be based on a formal allocation of money through the corporate budget, rather than a parsimonious sub allocation grudgingly granted by one or more departments. In the first case the funds are unreservedly given to the target costing effort, whereas in the latter case, they can be suddenly withdrawn by a department manager who is not fully persuaded of the need for target costing or who suddenly finds a need for the money elsewhere.
- **Assign a Strong Team Manager:** Because the typical target costing program involves so many people with different backgrounds and represents so many parts of a company, it can be difficult to weld the group together into a smoothly functioning team focused on key objectives. The best way to ensure that the team functions properly is to assign to the effort a strong team manager skilled in dealing with management, the use of project tools, and working with a diverse group of people. This manager should be a full-time employee, so that his or her complete attention can be directed toward the welfare of the project.
- **Enroll Full-Time Participants:** A target costing team member puts the greatest effort into the program when he or she is focused only on target costing. Thus, it is essential that as many members of the team as possible be devoted to it full-time rather than also trying to fulfill other commitment elsewhere in the company at the same time. This may call for the replacement of these individuals in the departments they are leaving so that there are no

emergencies requiring their sudden withdrawal back to their “home” departments to deal with other work problems. It may even be necessary to permanently assign them to a target costing program, providing them with a single focus on ensuring the success of the target costing program because their livelihood are now tied to it. As discussed above, a full-time Management Accountant should be employed for target costing who carries out the cost-benefit analysis on a continuous basis.

- **Use Project Management Tools:** Target costing can be a highly complex effort especially for high-cost products with many features and components. To ensure that the project stays on track, the team should use all available project management tools, such as Microsoft Project (for tracking the completion of specific tasks), a company database containing various types of costing information, and a variety of product design tools. All these items require assured access to many corporate databases, as well as a budget for whatever computing equipment is needed to access this data.

The main focus of the step described in this section is to ensure the fullest possible support for target costing by all available means—management, money and staff. Only when all these elements are in place and concentrated on the goals at hand does a target costing program have the greatest chance for success.

Illustration

Kowloon Toy Company (KTC) expects to successfully launch Toy “H” based on a Disney character. KTC must pay 15% royalty on the selling price to the Disneyland. KTC targets a selling price of ₹100 per toy and profit of 25% on selling price.

The following are the cost data forecast:

	₹/toy
Component H ₁	8.50
Component H ₂	7.00
Labour: 0.40 hr. @ ₹60 per hr.	24.00
Product Specific Overheads	13.50

In addition, each toy requires 0.6 kg of other materials, which are supplied at a cost of ₹16 per kg. with a normal 4% substandard quality, which is not usable in the manufacture.

Required

DETERMINE if the above cost structure is within the target cost. If not, what should be the extent of cost reduction?

Solution**Target Cost “H”**

₹ / Toy	
Target Selling Price	100.00
Less: Royalty @15%	15.00
Less: Profit @ 25%	25.00
Target Cost	60.00

Cost Structure “H”

₹ / Toy	
Component H ₁	8.50
Component H ₂	7.00
Labour (0.40 hr. × ₹ 60 per hr.)	24.00
Product Specific Overheads	13.50
Other Material (0.6 kg / 96% × ₹16)	10.00
Total Cost of Manufacturing	63.00

Total Cost of Manufacturing is ₹ 63 while Target Cost is ₹ 60. Company KTC should make efforts to **reduce its manufacturing cost by ₹ 3** to achieve Target Selling Price of ₹100.

Case Scenario

Kaveri Ltd. (KL) is a manufacturer of bikes in India and it sells them in India and outside India. KL has just launched the World's smallest and most affordable bike called 'Zingaroo'. The bike is mounted with all-aluminium, single cylinder, air cooled, 99.2 cc engine. The engine makes just over 8 bhp power and 8 Nm of torque, but it stakes claim to be the fuel-efficient bike, with a claimed figure of 88 kmpl. It has been creating competition for two wheelers as none of the Indian companies as well as foreign companies, offer a bike for such a competitive price within the reach of middle class family.

KL has adopted target costing technique in manufacturing this bike. For KL, maintaining target-price was difficult. During the designing and production process of bike, input costs increased frequently. However, KL designed various components especially for bike to maintain the target price. Though, one curiosity how this can be done in the future when input costs are bound to increase further.

Many environmentalists have opposed the manufacture of this bike, because they believe that mass production of small bike (about 2.5 lakh bike every year) will create heavy pollution. Many people believe that this small bike is not up to the safety standards due to lightweight and use of aluminium and plastic frames. The design of this bike is entirely different from that of other bikes. This also causes a doubt that the existing bike mechanics would be able to repair or not.

Durability of bike is another issue in the Indian environment. Further, performance of 'Zingaroo' more or less depends upon the condition of roads and traffic system.

After the launch of 'Zingaroo', many other national and international automobile companies are also planning to manufacture small bike which will create tough competition in near future.

Required

Now you being a strategic performance analyst of KL, answer the following questions:

- (i) IDENTIFY strategy which KL has adopted for 'Zingaroo' bike?
- (ii) After adopting target costing, IDENTIFY issues and challenges faced by KL and suggest the remedial action to be taken to solve these issues?

Solution

- (i) KL has adopted *Low Cost Strategy* for "Zingaroo" bike since the main purpose of manufacturing this bike was to make it cheapest and affordable.
- (ii) The issues and challenges faced by KL and their remedial action are as follows:

Maintaining of Target Price

'Zingaroo' bike is one of the world's cheapest and smallest bike. Maintaining target-price proved to be a big challenge for the KL since input cost of bike are bound to increase further in future. The initial value engineering may not uncover all possible cost savings. Thus, Kaizen Costing may be designed to repeat many of the value engineering steps for as long as a bike is produced, constantly refining the process and thereby stripping out extra costs.

Environmental Issues

Many environmentalists have opposed the manufacture of bike as they believe that mass production of small bikes will create heavy pollution since automobile pollution is already a big problem for a country like India. For this issue, 'Zingaroo' bike can be prepared based on BS emission norms. These norms restrict the pollution created by any motor vehicle.

Safety Issues

Since 'Zingaroo' bike is made of aluminium and plastic frames so this may also create safety issues for the customers. For such issues, KL should meet safety standards. Further, KL should make people aware that 'Safety is Primary' / 'Drive Safely'.

Servicing/ Repairing Facilities

The design of 'Zingaroo' bike is entirely different from that of other bikes. This causes a doubt that the existing bike mechanics would be able to repair or not. For such problem, creation of a good network of service center can be a solution i.e. repair center should be established on required places.

Durability

Durability of 'Zingaroo' bike is another issue in the Indian environment. The performance of bike more or less depends upon the condition of roads and traffic system. For such

issues, tyre quality and hydraulic brake system should be compatible to the roads and traffic system.

Global Competition

After the launch of 'Zingaroo', many other national and international automobile companies are also planning to manufacture a small bike, which will be a big challenge for the KL in the near future. To face such competition, it may adopt Kaizen Costing technique. The cost reductions resulting from Kaizen Costing are much smaller than those achieved with Value Engineering but are still worth the effort since competitive pressures are likely to force down the price of 'Zingaroo' over time, and any possible cost savings allow KL to still attain its targeted profit margins while continuing to reduce cost.

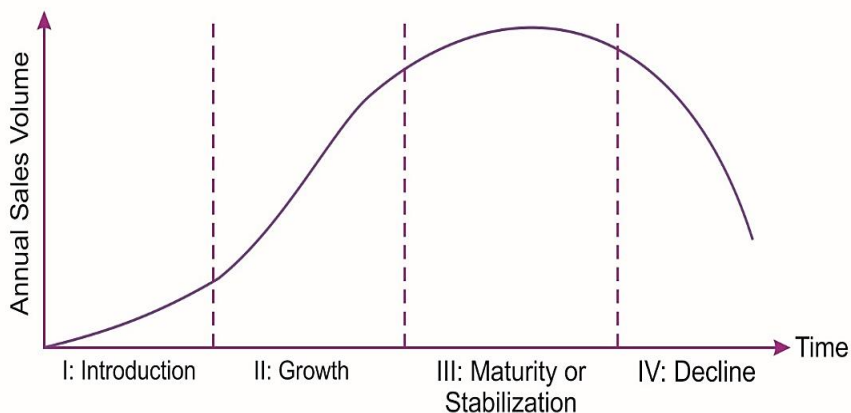
LIFE CYCLE COSTING

Life Cycle Costing involves identifying the costs and revenue over a product's life i.e. from inception to decline. Life cycle costing aims to maximize the profit generated from a product over its total life cycle. Understanding this can be a useful analysis tool and can help to suggest which strategies the organisation needs to adopt in order to compete successfully.

Product Life Cycle

Each product has a life cycle. The life cycle of a product varies from a few months to several years. Product life cycle is thus a pattern of expenditure, sales level, revenue and profit over the period from new idea generation to the deletion of product from product range.

The life cycle of a product consists of four phases/ stages viz., Introduction; Growth; Maturity; Saturation and Decline.



Stage I: Introduction Stage

Stage one is where the new product is launched in the market. As the product is novel, there is minimal awareness and acceptance of it. Competition is almost negligible and profits are non-existent. The length of the introduction stage differs from product to product depending on various factors.

Characteristics

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

Strategies

- Attracting customers by raising awareness of the product through promotion activities.
- Inducing customers to try and buy the product.
- Strengthening or expanding channel and supply chain relationships.
- Building on the availability and visibility of the product that boost channel intermediaries to support the product.
- Setting price in alignment with the competitive realities of the market.

Stage II: Growth Stage

The next stage in the product life cycle is growth stage. Sales begin to expand rapidly because of greater customer awareness. Competitors enter the market often in large numbers. As a result of competition, profit starts declining near the end of the growth stage.

Characteristics

High volume of business and increase in competition	Sales increase at an increased rate in early growth stage	New channels to handle additional volumes and new markets
Shift of emphasis from product awareness to product conviction	Overall strategy for trade-off between high profits and high market share	Improving and/or adding features or strategic lowering of prices to attract more buyers
Same promotional spending or slightly higher	Educating market is main goal	The length of the growth stage varies according to the nature of the product and competitive reactions

Strategies

- Establish a clear brand identity through promotional campaigns.
- Maintain control over product quality to assure customer satisfaction.
- Maximize availability of the product through strong distribution channel.
- Find the ideal balance between price and demand as per price elasticity.
- Overall strategy shifts from acquisition to retention of customers, from motivating product trial to generating repeat purchases and building brand loyalty.
- Development of long-term relationships with customers and partners for the maturity stage.
- Value-based pricing strategies may be considered.
- Leverage the product's *perceived* differential advantages to secure a strong market position.

Stage III: Maturity Stage

During the stage of maturity sales continue to increase, but at a decreasing rate. When sales level off, profits of both producers and middlemen decline. The main reason is intense price competition; some firms extend their product lines with new models. This stage poses difficult challenges.

Characteristics

Overcapacity in the industry	Intensified competition	Population growth and replacement demand govern future sales
Some laggard buyers still enter the market	Profits start to decline	No new distribution channels to fill
Customers start moving towards other products and substitutes	Strong marketing challenges	High R & D budgets

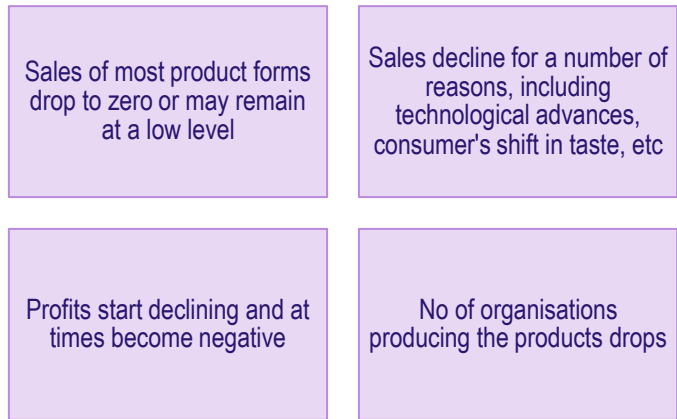
Strategies

- Strong marketing efforts are needed to win over the competitor's customers.
- Product features may be improved or enhanced to differentiate product from that of the competitors.
- Prices may have to be reduced to attract the price-sensitive consumers.
- Various sales promotion incentives are necessary for the consumers as well as dealers to maintain their interest in the product.
- Distribution becomes more intensive and incentives may be offered to encourage product over competing products.

Stage IV: Decline Stage

Decline in sales volume characterizes this last stage of the product life cycle. The need or demand for product disappears. Availability of better and less costly substitutes in the market accounts for the arrival of this stage.

Characteristics



Strategies

- The product can be maintained in the market by differentiation, keeping low cost for some more time by adding certain new features and finding new uses.
- The firm can continue to offer the product to its loyal customers (niche segment) at a reduced price.
- Firm can even discontinue the product.
- Use the product as replacement product for launching another new product successfully in the market.
- The various marketing decisions in the decline stage will depend on the fact that, whether it is being revived, or given a new lease of life, or left unchanged if it is being liquidated.
- The price may be maintained or reduced drastically if liquidated.

Life Cycle Characteristics

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

Strategies

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

(Sources- Stages- Characteristics/ Strategies: Marketing Strategy, Text and Cases By O. C. Ferrell, Michael Hartline; Principles of Marketing By Philip Kotler)

Characteristics of Product Life Cycle

The major characteristics of product life-cycle concept are as follows:

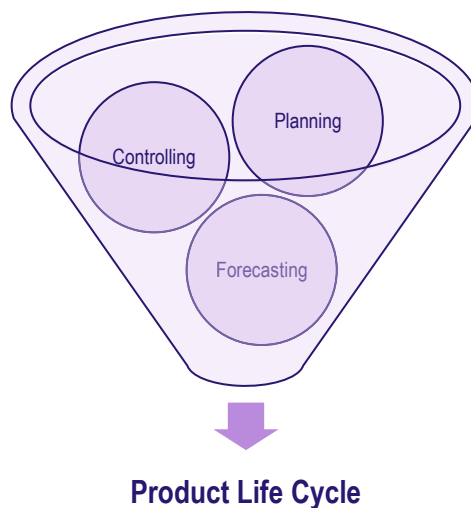
- The products have finite lives and pass through the cycle of development, introduction, growth, maturity, decline and deletion at varying speeds.
- Product cost, revenue and profit patterns tend to follow predictable courses through the product life cycle. Profits first appear during the growth stage and after stabilising during the maturity stage, decline thereafter to the point of deletion.
- Profit per unit varies as products move through their life cycles.
- Each stage of the product life-cycle poses different threats and opportunities that give rise to different strategic actions.
- Products require different functional emphasis in each stage-such as an R&D emphasis in the development stage and a cost control emphasis in the decline stage.
- Finding new uses or new users or getting the present users to increase their consumption may extend the life of the product.

Benefits of Product Life Cycle Costing

The benefits of product life cycle costing are summarized as follows:

- The product life cycle costing results in *earlier actions to generate revenue or to lower costs* than otherwise might be considered. There are a number of factors that need to be managed in order to maximise return on a product.
- Better decisions should follow from a *more accurate and realistic assessment of revenues and costs*, at least within a particular life cycle stage.
- Product life cycle thinking can promote *long-term rewarding* in contrast to short-term profitability rewarding.
- It provides an *overall framework for considering total incremental costs over the entire life span of a product*, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.
- It is an approach used to provide a *long-term picture of product line profitability*, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.
- It is also considered as a way to enhance the *control of manufacturing costs*. The thrust of product life cycle costing is on the distribution of costs among categories changes over the life of the product, as does the potential profitability of a product. Hence it is important to track and measure costs during each stage of a product's life cycle.
- Product life cycle costing *traces research and design and development costs etc.*, incurred to individual products over their entire life cycles, so that the total magnitude of these costs for each individual product can be reported and compared with product revenues generated in later periods.

Uses of Product Life Cycle (PLC)



- As a Planning tool, it characterizes the marketing challenges in each stage and poses major alternative strategies, i.e. application of kaizen.
- As a Control tool, the PLC concept allows the company to measure product performance against similar products launched in the past.
- As a Forecasting tool, it is less useful because sales histories exhibit diverse patterns and the stages vary in duration.

Illustration

Y-Connections, China based firm, has just developed ultra-thintablet S-5 with few features like the ability to open two apps at the same time. This tablet cost ₹ 5,00,000 to develop; it has undergone extensive research and is ready for production. Currently, the firm is deciding on plant capacity, which could cost either ₹ 35,00,000 or ₹ 52,00,000. The additional outlay would allow the plant to increase capacity from 500 units to 750 units. The relevant data for the life cycle of the tablet at different capacity level are as under:

Expected Sales	500 units	750 units
Sale Price	₹ 79,600 per unit	₹ 69,600 per unit
Variable Selling Costs	10% of Selling Price	10% of Selling Price
Salvage Value - Plant	₹ 6,25,000	₹ 9,00,000
Profit Volume Ratio	40%	

Required

ADVISE Y-Connections, regarding the 'Optimal Plant Capacity' to install. The tablet's life cycle is two years.

Note: Ignore the time value of money.

Solution

Advice

Based on the above 'Expected Profit' statement which is purely based on *financial considerations* firm may go for high price – low volume i.e. 500 units level. However, *non-financial considerations* are also given due importance as they account for actions that may not contribute directly to profits in the short run but may contribute significantly to profits in long run. Here, it is important to note that life cycle of product is two years and there is no significant difference between the profits at both levels. In this scenario firm may opt the plant having high capacity *not only to increase its market share but also to establish a long term brand image.*

Workings**Statement Showing “Variable Manufacturing Cost per unit”**

Particulars	₹ / unit
Sales	79,600
Less: Contribution (40%)	31,840
Variable Cost	47,760
Less: Variable Selling Costs ($₹79,600 \times 0.1$)	7,960
Variable Manufacturing Cost	39,800

Statement Showing “Expected Profit”

Particulars	('000) ₹ / unit	
	500 units	750 units
Sales	39,800 (₹79,600 × 500)	52,200 (₹69,600 × 750)
Less: Variable Mfg. Cost	19,900 (₹39,800 × 500)	29,850 (₹39,800 × 750)
Less: Variable Selling Cost	3,980 (₹39,800 × 0.1)	5,220 (₹52,200 × 0.1)
Add: Salvage Value	625	900
Less: Cost of Plant	3,500	5,200
Net Profit	13,045	12,830

Development cost is sunk and is not relevant.


PARETO ANALYSIS

Pareto Analysis is a rule that recommends focus on the most important aspects of the decision making in order to simplify the process of decision making. It is based on the 80: 20 rule that was a phenomenon first observed by Vilfredo Pareto, a nineteenth century Italian economist. He noticed that 80% of the wealth of Milan was owned by 20% of its citizens. This phenomenon, or some kind of approximation of it say, (70: 30 etc.) can be observed in many different business situations. The management can use it in a number of different circumstances to direct management attention to the key control mechanism or planning aspects. It helps to clearly establish top priorities and to identify both profitable and unprofitable targets.

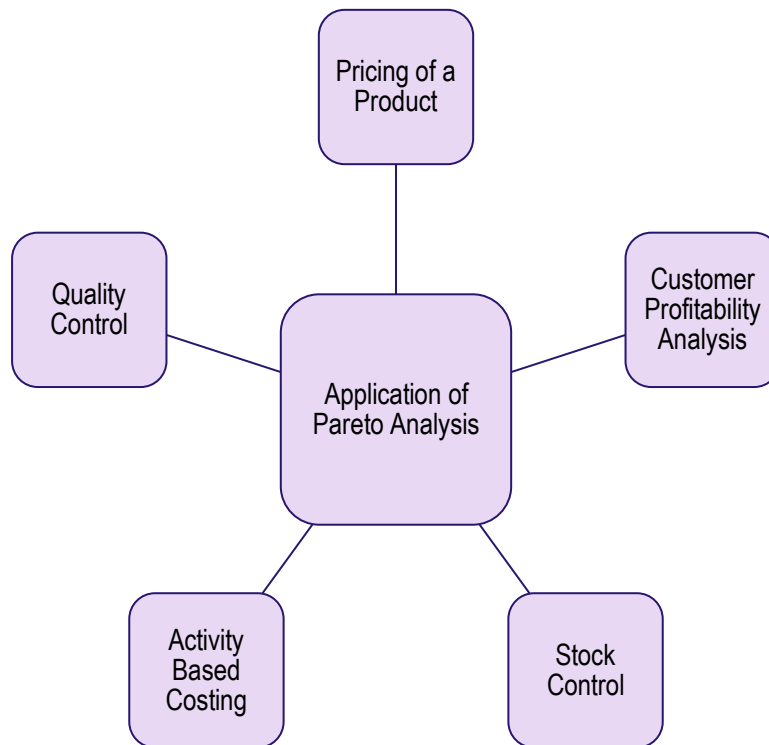
Usefulness of Pareto Analysis

It provides the mechanism to control and direct effort by fact, not by emotions. It helps to clearly establish top priorities and to identify both profitable and unprofitable targets. Pareto analysis is useful to:

- Prioritize problems, goals, and objectives to identify root causes.
- Select and define key quality improvement programs.
- Select key customer relations and service programs.
- Select key employee relations improvement programs.
- Select and define key performance improvement programs.
- Allocate physical, financial and human resources.

Applications of Pareto Analysis

Pareto analysis may be applicable in the presentation of Performance Indicators data through selection of representative process characteristics that truly determine or directly or indirectly influence or conform the desired quality or performance result or outcome. The Pareto Analysis is generally applicable to the following business situations:



Pricing of a Product

- In the case of a firm dealing with multi products, it would not be possible for it to analyse cost-profit-price-volume relationships for all of them. In practice, in case of such firm approximately 20% of products may account for about 80% of total sales revenue. Pareto Analysis is used for analysing the firm estimated sales revenues from various products and it might indicate that approximately 80% of its total sales revenue is earned from about 20% of its products.

- Such analysis helps the top management to delegate the pricing decision for approximately 80% of its products to the lower levels of management, thus freeing themselves to concentrate on the pricing decisions for products approximately 20% which are essential for the company's survival.
- Thus, a firm can adopt more sophisticated pricing methods for small proportion of products that jointly accounts for approximately 80% of total sales revenue. For the remaining 80% of the products which account for 20% of total sales revenue the firm may use cost based pricing method.

Customer Profitability Analysis

- Instead of analysing products, customers can be analysed for their relative profitability to the organisation.
- Again, it is often found that approximately 20% of customers generate 80% of the profit. There will always be some customers who are less profitable than others, just as some products are less profitable than others.
- Such an analysis is useful tool for evaluation of the portfolio of customer profile and decision making such as whether to continue serving a same customer group, what is the extent of promotion expenses to be incurred.

ABC Analysis- Stock Control

- Another application of Pareto analysis is in stock control where it may be found that only a few of the goods in stock make up most of the value. In practice, approximately 20% of the total quantity of stock may account for about 80% of its value. The outcome of such analysis is that by concentrating on small proportion of stock items that jointly accounts for 80% of the total value, a firm may well be able to control most of monetary investment in stocks.

Application in Activity Based Costing

- In Activity Based Costing it is often said that 20% of an organisation cost drivers are responsible for 80% of the total cost. By analysing, monitoring and controlling those cost drivers that cause most cost, a better control and understanding of overheads will be obtained.

Quality Control

- Pareto analysis seeks to discover from an analysis of defect report or customer complaints which "vital few" causes are responsible for most of the reported problems.
- Often, 80% of reported problems can usually be traced to 20% of the various underlying causes. By concentrating once efforts on rectifying the vital 20%, one can have the greatest immediate impact on product quality.
- The Pareto Analysis indicates how frequently each type of failure (defect) occurs. The purpose of the analysis is to direct management attention to the area where the best returns can be achieved by solving most of quality problems, perhaps just with a single action.

Illustration

The following information is given about the type of defects during a production period and the frequencies of their occurrence in a spectacle manufacturing company:

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

Required

PREPARE a frequency table so that a Pareto Chart can be constructed for the defect type. Also, IDENTIFY key areas of focus.

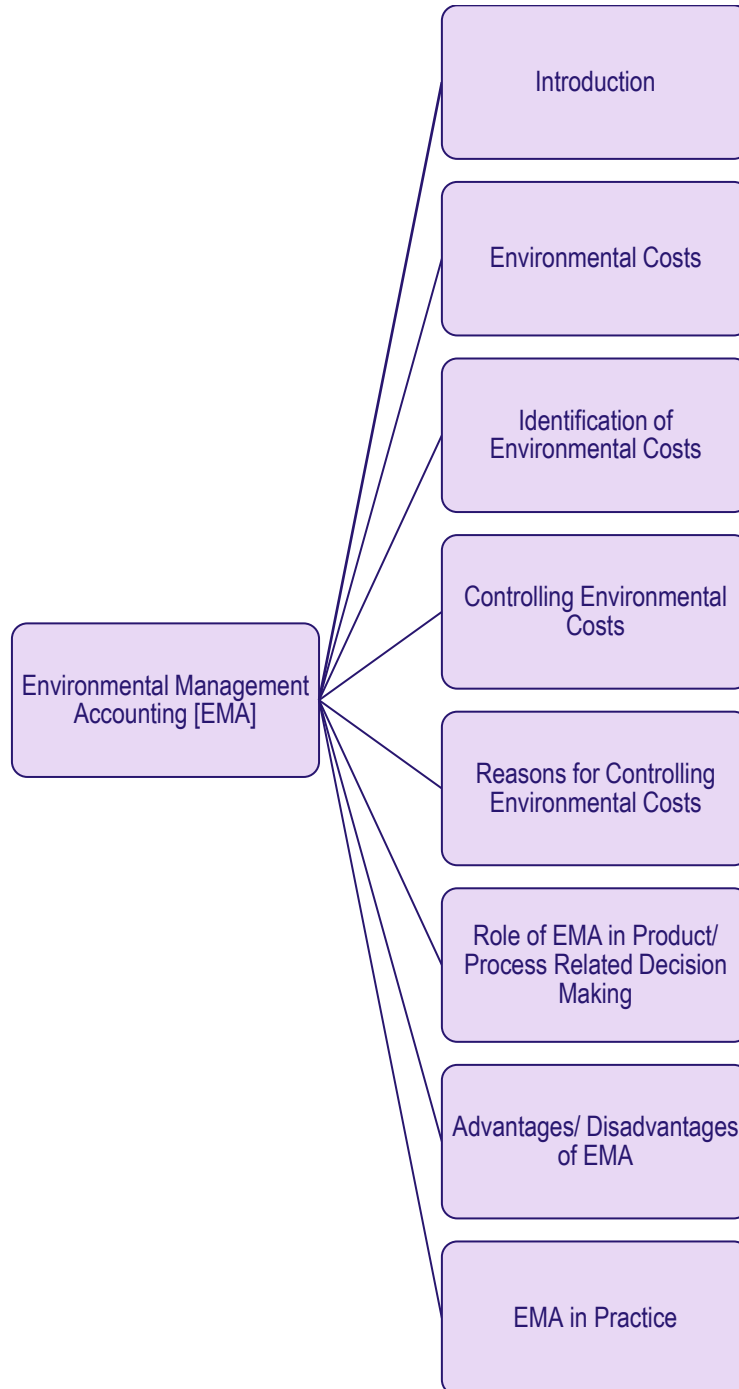
Solution**Statement Showing "Pareto Analysis of Defects"**

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

The company should focus on eliminating scratches on the surface, rough edges of lenses and grinding of lenses related defects which constitute 80% portion, according to Pareto Theory.



ENVIRONMENTAL MANAGEMENT ACCOUNTING [EMA]



EMA is the process of collection and analysis of the information relating to environmental cost for internal decision making. EMA identifies and estimates the costs of environment-related activities and seeks to control these costs. The focus of EMA is not on financial costs but it also considers the environmental cost or benefit of any decisions made. EMA is an attempt to integrate best management accounting thinking with best environmental management practice.

EMA can be viewed as a part of the environmental accounting framework and is defined as using monetary and physical information for internal management use. Though EMA information can be used in any management decision making process, it is particularly useful for environmental decision making. EMA aims to make a better use of or to modify sources of information and management accounting techniques and to evaluate sustainability and/or environmental efficiency of a company.

The major areas for the application for EMA are:

- Product Pricing
- Budgeting
- Investment Appraisal
- Calculating Costs and
- Savings of Environmental Projects, or Setting Quantified Performance Targets.

Environmental Costs

The US Environmental Protection Agency in 1998 has categorized Environmental Costs in four sections:

- *Conventional Costs*: Raw material and energy costs having environmental relevance.
- *Hidden Costs*: Costs which have been accounted for but then lose their identity in 'general overheads'.
- *Contingent Costs*: Costs to be incurred at a future date – for example, clean- up costs.
- *Relationship Costs*: Intangible Costs, for example, the costs of preparing environmental reports.

The United Nations Division for Sustainable Development (UNSD), on the other hand, described Environmental Costs as comprising of:

- Costs incurred to protect the environment – for example, measures taken to prevent pollution, and
- Costs of wasted material, capital and labor, i.e. inefficiencies in the production process.

Neither of these definitions contradicts each other; they just look at the costs from slightly different angles.

In practice, Environmental Costs can be split into further two categories: Internal Costs and External Costs. *Internal Costs* have direct impact on the income statement of a company. On the other hand, *External Costs* are imposed on society at large, but not borne by the company that generates the cost in the first instance. Recently governments of many countries are becoming increasingly aware of these external costs and are using taxes and regulations to convert them to internal costs. For example, if the activities of companies lead to forest degradation they might be required to have a tree replacement programme, or they may be granted lower tax allowances on vehicles that cause a high degree of harm to the environment.

Hansen and Mendoza (1999) point out that environmental costs are incurred because of poor quality controls. They advocate the use of a periodical environmental cost report, based on the principles of *cost of quality report*, with each category of cost being expressed as a percentage of sales revenues or operating costs so that comparisons can be made between different periods and/or organisations. The categories of costs would be as follows:

- Environmental Prevention Costs– Those costs associated with *preventing* adverse environmental impacts. Examples include
 - Evaluating and picking pollution control equipment
 - Creating environmental policies
 - Environmentally driven R & D
 - Site and feasibility studies
 - Investment in protective equipment
- Environmental Appraisal Costs– The cost of activities executed to determine whether products, process and activities are in *compliance* with environmental standards, policies and laws. Examples include
 - Monitoring, testing, inspection and reporting
 - Improved systems and checks in order to prevent fines/ penalties
 - Regulatory compliances
 - Performing contamination tests
 - Audit of environmental activities
- Environmental Internal Failure Costs – Costs incurred from activities that have been produced but *not discharged* into the environment. Examples include
 - Recycling scrap
 - Disposing toxic material
 - Back end costs such as decommissioning costs on project completion
- Environmental External Failure Costs – Costs incurred on activities performed *after discharging* waste into the environment. These costs have adverse impact on the organisation's *reputation* and *natural resources*. Examples include
 - Cleaning up contaminated soil.
 - Restoring land to its natural state

The environmental cost report should be similar in format to the cost of quality report. Some companies have started linking their environmental strategy to concrete performance measures via **balanced scorecard framework**.

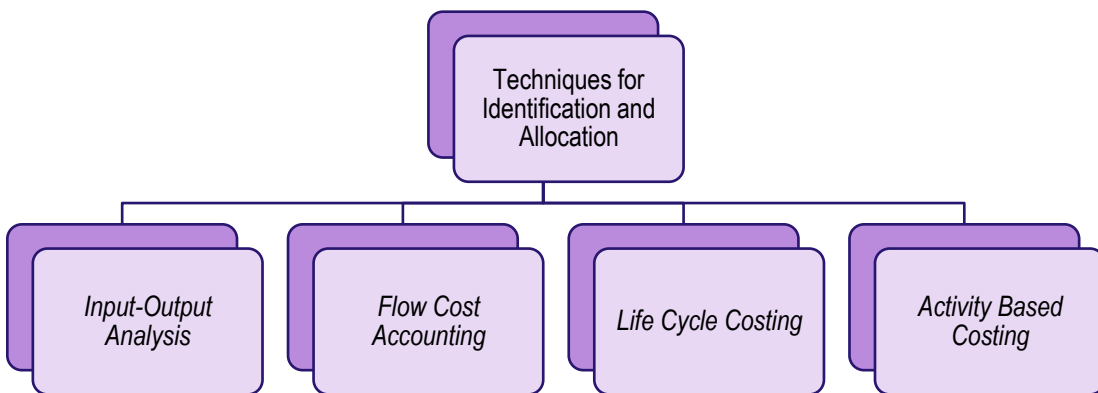
(Source: *Management Accounting for Business* By Colin Drury)

Identification of Environmental Costs

To prepare environmental management accounts an intense review of general ledger containing costs of materials, utilities and waste disposal etc. is required. Since the *environmental costs are generally 'hidden' in 'general overheads' of the company*, it becomes difficult for management to identify opportunities to cut environmental costs but nonetheless it is crucial for them to do so to preserve natural resources getting scarcer.

Allocation of environmental costs to the processes or products which give rise to them is equally important for organisations in making well-informed business decisions. For example, a pharmaceutical company has to decide on the production of one of its drugs. In order to incorporate environmental aspects into its decision, it needs to know exactly how many products are input into the process compared to its outputs; how much waste is created during the process; how much labour and fuel is used in making the drug; how much packaging the drug uses and what percentage of that is recyclable etc. Only by identifying these costs and allocating them to the product can an informed decision be made about the environmental effects of continued production.

In 2003, the UNDSO identified four management accounting techniques for the Identification and Allocation of Environmental Costs:



Input-Output Analysis

This technique records material inflows and balances this with outflows on the basis that, what comes in, must go out. So, if 100kg of materials have been bought and only 80kg of materials have been produced, for example, then the 20kg difference must be accounted for in some way. It may be, for example, that 10% of it has been sold as scrap and 90% of it is waste. By accounting for outputs in this way, both in terms of physical quantities and, at the end of the process, in monetary terms too, businesses are forced to focus on environmental costs.

Flow Cost Accounting

This technique uses not only material flows but also the organizational structure. Classic material flows are recorded as well as material losses incurred at various stages of production. Flow cost accounting makes material flows transparent by using various data, which are quantities (physical data), costs (monetary data) and values (quantities x costs). The material flows are divided into three categories, material, system, and delivery and disposal.

The *material* values and costs apply to the materials which are involved in the various processes. The *system* values and costs are the in-house handling costs, which are '...incurred inside the company for the purpose of maintaining and supporting material throughput, e.g. personnel costs or depreciation,' (UNSD, 2003).

The *delivery and disposal* values and costs refer to the costs of flows leaving the company, for example transport costs or cost of disposing waste. EMA can benefit from flow cost accounting because it aims to reduce the quantities of materials, which leads to increased ecological efficiency (UNSD, 2003).

Life Cycle Costing

Lifecycle costing considers the costs and revenues of a product over its whole life rather than one accounting period. Therefore, the full environmental cost of producing a product will be taken into account. In order to reduce lifecycle costs an organization may adopt a TQM approach.

It is arguable that TQM and environmental management accounting are inextricably linked insofar as good environmental management is increasingly recognized as an essential component of TQM. Such organizations pursue objectives that may include zero complaints, zero spills, zero pollution, zero waste and zero accidents. Information systems need to be able to support such environmental objectives via the provision of feedback - on the success or otherwise - of the organizational efforts in achieving such objectives.

Activity Based Costing (ABC)

ABC allocates internal costs to cost centres and cost drivers on the basis of the activities that give rise to the costs. In an environmental accounting context, it distinguishes between **environment-related costs**, which can be attributed to joint cost centres, and **environment-driven costs**, which tend to be hidden on general overheads.

The environment-driven costs are removed from general overheads and traced to products or services. The cost drivers are determined based on environment impact that activities have and costs are charged accordingly. This should give a good attribution of environmental costs to individual products and should result in better control of costs.

Schaltegger and Muller (1998) stated 'the choice of an adequate allocation key is crucial for obtaining correct information'. The four main allocation keys are:

- Volume of emissions or waste
- Toxicity of emission and waste treated
- Environmental impact added (volume x input per unit of volume) volume of the emissions treated and
- The relative costs of treating different kinds of emissions.

Controlling Environmental Costs

After Identification and Allocation of Environmental Costs, task of controlling starts. Suppose ABC Ltd.'s main *environmental costs* are as follows:

- Water consumption
- Energy

- Transport and travel
- Consumables and raw materials.

An organization may try to control these cost as mentioned below-

Waste

'Mass balance' approach can be used to determine how much material is wasted in production, whereby the weight of *materials bought is compared to the product yield*. From this process, potential cost savings may be identified. In addition to these monetary costs to the organization, waste has environmental costs in terms of lost land resources (because waste has been buried) and the generation of greenhouse gases in the form of methane. Costs of unused raw materials and disposal; taxes for landfill; fines for compliance failures such as pollution are considered as environmental cost associated with waste.

Water

Businesses pay for water twice – first, to buy it and second, to dispose of it. If savings are to be made in terms of reduced water bills, it is important for organizations to identify where water is used and how consumption can be decreased.

Energy

Often, energy costs can be reduced significantly at very little cost. Environmental management accounts may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings.

Transport and Travel

Again, EMA techniques may be used to identify savings in terms of travel and transport of goods and materials. At a simple level, a business can invest in more fuel-efficient vehicles, for example.

Consumables and Raw Materials

These are directly attributable costs and discussions with management can reduce such costs. For example, toner cartridges for printers could be refilled rather than replaced.

This should produce a saving both in terms of the financial cost for the organization and a waste saving for the environment (toner cartridges are difficult to dispose of and less waste is created this way).

Case Scenario

CNB Oil Ltd., an Indian oil company, is the leading manufacturer of all streams of oil and engaged in refining (processing capacity 50 MMTA of crude oil), pipeline transportation and marketing of petroleum products to research & development, exploration & production, marketing of natural gas and petrochemicals. The company has high-caliber employees, sophisticated technologies and leading-edge R&D. By venturing itself into the renewables and the nuclear energy, CNB has grown and evolved itself from a pure petroleum refining and marketing company to a full-fledged energy company. Due to government's new environmental policy, environmental report is mandatorily required to be submitted yearly for the prescribed industries polluting environment substantially otherwise would be penalized. Energy sector also falls in these prescribed industries. CNB has already taken initiatives to control air pollution and

water pollution like use of low sulphur fuel oil in boilers and heaters & NOx burners to minimize gas emission, network of underground sewers for segregated collection of various wastewater streams for waste water management, however while preparing and analyzing environmental report, Mr. K V Sharma, CEO, is not happy with high environmental cost in terms of Waste (oily / chemical / biological sludge, scrape batteries, e-waste, chemical containers, effluents etc.), Raw Material Consumption, Water Consumption, Energy and Transportation. He raised his concern with Board of Directors and they have decided to appoint you as an environmental management accounting expert to manage environmental cost.

Required

APPLY Environmental Management Accounting in CNB to manage environmental costs.

Solution

Environmental Management Accounting (EMA) is the process of collection and analysis of the information relating to environmental cost for internal decision making. EMA identifies and estimates the cost of environment related activities and seek to control these cost.

In CNB, during refinery operations, waste water, fugitive emissions, flue gases and solid wastes are generated. Due to this excess waste and gas emission, environmental cost rises. Scarce natural resources should be used in such a way so that their consumption is sustainably optimized. In order to cutback environmental cost, EMA can be applied as follows:

Waste

CNB should measure, manage and monitor waste from operations in order to minimise impact on people and the environment. 'Mass balance' approach can be used to determine how much material is wasted in production, whereby the weight of materials bought is compared to the product yield. From this process, potential cost savings may be identified.

In CNB, wastes are oily / chemical / biological sludge, scrape batteries, e-waste, chemical containers, effluent etc. Waste generated in operations is either treated within the premise or disposed through approved waste treatment, storage, and disposal facility. To avoid the usage of chemical drums/ containers in large quantity, separate storage tanks can be created for bulk storage of additives to reduce the drum procurement and disposal.

Further, refineries in operation should be upgraded from time to time to minimize waste.

Water Management

Businesses pay for water twice – first, to buy it and second, to dispose of it. If savings are to be made in terms of reduced water bills, it is important for CNB to identify where water is used and how consumption can be decreased.

For water conservation, sustainable water management techniques should be adopted. In refining operation, water is mainly used in boilers and cooling units. Collective efforts should be made to optimize water consumption and maximum reuse of used water. Advanced treatment system like rain water harvesting, ultra-filtration, reverse osmosis etc. may be used for water purification for further use. This would lead to substantial reduction in intake of fresh water.

In addition, CNB staff should be alerted for water conservation through seminars, presentations, conference, awareness campaigns.

Energy

Often, energy costs can be reduced significantly at very little cost. Environmental Management Accounts may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings. Some of energy conservation initiatives may be taken by CNB like:

- Conducting periodic energy audits for identifying energy saving opportunities.
- Phasing out conventional lights and replacement with LED lights/induction lights.
- Power factor improvement by installation of capacitor banks.
- Installation of 5 star rated energy equipment.
- Prevention of idle running of equipment.
- Installation of solar lights.
- Use of Nano molecular thermal additives in ACs.
- Installation of efficient energy monitoring system for energy intensive equipment.
- Capacity improvement for batteries.

Consumables and Raw Material

Refineries 'refine' crude oil in massive quantities, to produce the fuels need. There should be continuously monitoring on optimum utilization of crude oil to improve gross refining margin. The gross refining margin is the difference between the total value of petroleum products coming out of an oil refinery (output) and the price of the raw material, (input) which is crude oil. Even not only crude oil there should also be optimum and sustainable utilization of resources like additives, chemicals etc. from procurement to production stages.

CNB may use recyclable technology for raw material and consumable wastages which provides sustainability in terms of environmental protection and reduction in carbon footprint. Periodic testing should be performed to assess the health of equipment and pipelines as to have better process of raw materials and consumables.

Transport

Again, EMA may be used to identify saving in terms of transport of goods and materials. At CNB, in order to cutback emission and fuel consumption due to transportation, route optimization activity may be used like allocation of customer on the basis of nearest depots and locations as to reduce distance, real time fleet tracking using GPS (to make sure that vehicles do not deviate from assigned shortest route) etc.

Reasons for Controlling Environmental Cost

There are three main reasons why the management of environmental costs is becoming increasingly important in organizations.

First, a 'carbon footprint' (as defined by the Carbon Trust) measures the total greenhouse gas emissions caused directly and indirectly by a person, organization, event or product. People are now becoming aware about the 'carbon footprint' and recycling. Several companies have initiated CSR committees as they feel that portraying themselves as environmentally responsible makes them popular among consumers.

Second, environmental costs are becoming huge for some companies, particularly those operating in highly industrialized sectors such as oil production. In some cases, these costs can amount to more than 20% of operating costs. Such significant costs need to be managed.

Third, regulation is increasing worldwide at a rapid pace, with penalties for non-compliance also increasing accordingly. In the largest ever seizure related to an environmental conviction in the UK, a plant hire firm, John Craxford Plant Hire Ltd, had to not only pay £85,000 in costs and fines but also got £1.2m of its assets seized. This company had illegally buried waste and breached its waste and pollution permits. And it's not just the companies that need to worry. Every person found guilty of breaching environmental regulations knowingly are liable to criminal prosecution as per the regulatory laws.

The management of environmental costs is not an easy process. This is because first, just as EMA is difficult to define, so too are the actual costs involved. Second, having defined them, some of the costs are difficult to separate out and identify. Third, the costs can need to be controlled but this can only be done if they have been correctly identified in the first place.

Role of EMA in Product/ Process Related Decision Making

The correct costing of products is a pre-condition for making sound business decisions. The accurate product pricing is needed for strategic decisions regarding the volume and choices of products to be produced. *EMA converts many environmental overhead costs into direct costs and allocate them to the products that are responsible for their incurrence.* The results of improved costing by EMA may include:

- Different pricing of products as a result of re-calculated costs;
- Re-evaluation of the profit margins of products;
- Phasing-out certain products when the change is dramatic;
- Re-designing processes or products in order to reduce environmental costs and
- Improving housekeeping and monitoring of environmental performance.

Advantages of EMA

Improving Revenue

Production of new products or services meeting the environmental needs or concerns of customers can lead to increased sales. It may also be possible to sell such products for a premium price. Improved sales may also be a consequence of improving the reputation of the business.

It is possible that in the future, rather than good environmental management resulting in improved sales, poor management will lead to losses. All businesses will be expected to meet a minimum standard related to environmental issues.

Cost Reductions

Paying close attention to the use of resources can lead to reductions in cost. Often simple improvements in processes can lead to significant costs savings.

Disadvantages of EMA

Increases in Costs

Cost of complying with legal and regulatory requirements, and additional costs to improve the environmental image of the organization may result in increase in some costs. However, some of these costs may be offset by government grants and this expenditure may save money in the long-term as measures taken may prevent future losses.

Costs of Failure

Significant costs may be incurred if there is poor environmental management. Thus, the cost of clean-up and fines on violation of any government environmental policy may be huge.

Conclusion

The main difficulty associated with EMA is the identification and allocation of environmental costs. Due to this, Management Accounting Techniques can distort and misrepresent environmental issues, leading to managers making decisions that are bad for businesses and bad for the environment. Environmental issues need to be managed before they can be reported on, and this requires changes to management accounting systems as poor environmental behaviour may have a real adverse impact on the business and its finances. Punishment includes fines, increased liability to environmental taxes, loss in value of land, destruction of brand values, loss of sales, consumer boycotts and inability to secure finance, loss of insurance cover, contingent liabilities, law suits, and damage to corporate image.

EMA in Practice

Xerox Limited

Xerox Limited, a subsidiary of Xerox Corporation, introduced the concept of lifecycle costing for its logistic chain. Manufacturing photocopiers is the core business of Xerox. The photocopiers are leased rather than sold. This means the machines are returned to Xerox limited at the end of their lease. Previously, machines were shipped in a range of different types of packaging, which could rarely be re-used by customers to return the old copiers. The customer had to dispose of the original packaging and to provide new packaging to return the machine at the end of its lease, which in turn could not be used to re-ship other machines. So, Xerox ultimately lost the original costs and even had to bear the additional costs of disposal of the new packaging. A new system was invented which used a standard pack (tote). Two types of totes were introduced to suit the entire range of products sold by Xerox. Totes can be used for both new machines delivery and return carcasses. The whole-chain cost analysis showed the considerably lower cost of the tote system, compared to the previously existing system and the supply chain became more visible. The tote system resulted not only in cost savings but also in reduced 'de-pack' times and improved customer relations (Bennett and James, 1998b).



SUMMARY

- Cost Reduction and Cost Control– Cost Control involves a comparison of actual with the standards or budgets, to regulate the actual costs. Cost Reduction is the achievement of real and permanent reduction in unit cost of products manufactured.
- Scope of Cost Reduction– Cost Reduction efforts can be put in the following areas- a) Product Design, b) Organisation, c) Factory lay-out Equipment, d) Production Plan Programme and Method. It may be extended to administrative, selling and distribution methods, personnel management, purchase and material control, financial management, and other services.
- Target Costing– A structured approach to determining the cost at which a proposed product with specified functionality and quality must be produced, to generate a desired level of profitability at its anticipated selling price.

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

- Advantages of Target Costing– Proactive approach, top-to-bottom commitment to process and product innovation, helps to create a company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success, control systems to support and reinforce manufacturing strategies and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lowest cost, proper planning, enhances employee awareness and empowerment, partnership with suppliers, Minimize non-value-added activities, lowest cost value added activities, reduced time to market.
- Main Features of Target Costing System– Integral part of the design and introduction of new products, target selling price determined using various sales forecasting techniques, target selling price helps in establishment of target production volumes, given the relationship between price and volume, helps in establishing cost reduction targets, fair degree of judgement is needed where the allowable cost and the target cost differ, a series of intense activities required to translate the cost challenge into reality.
- Components of Target Costing System–

Value Analysis is a planned, scientific approach to cost reduction which reviews the material composition of a product and production design so that modifications and improvements can be made which do not reduce the value of the product to the customer or to the user.

Value Engineering is the application of value analysis to new products. Value engineering relates closely to target costing as it is cost avoidance or cost reduction before production.

The initial value engineering may not uncover all possible cost savings. Thus, Kaizen Costing is designed to repeat many of the value engineering steps for as long as a product is produced, constantly refining the process and thereby stripping out extra costs.

Further, Target Costing System is based on involving representatives of all the Value Chain such as suppliers, agents, distributors and existing after-sales service in the target costing system.

Issues dealt with during a Value Analysis/ Value Engineering review

- Can we eliminate functions from the production process?
- Can we eliminate some durability or reliability?
- Can we minimize the design?
- Can we design the product better for the manufacturing process?
- Can we substitute parts?
- Can we combine steps?
- Can we take supplier's assistance?
- Is there a better way?

A mix of all the value engineering steps noted above must be applied to each product design to ensure that the maximum permissible cost is safely reached.

- Problems with Target Costing– Development process can be lengthened to a considerable extent, large amount of mandatory cost cutting can result in finger-pointing in various parts of the company, difficult to reach a consensus on the proper design, requires the development of detailed cost data, reduce the quality of products due to the use of cheap components which may be of inferior quality, requirement of a good team leader.
- Most Useful Situations for Target Costing– Assembly-oriented industries, diversified product lines, factory automation through use of technologies, having shorter product life cycles, implementing JIT, value engineering, etc.
- Implementing a Target Costing System– Create a Project Charter, Obtain a Management Sponsor, Obtain a Budget, Assign a Strong Team Manager, Enroll Full-Time Participants, Use Project Management Tools, Fullest possible support for target costing by all available means—management, money and staff. Only when all these elements are in place and concentrated on the goals at hand does a target costing program have the greatest chance for success.
- Pareto Analysis– Pareto Analysis is a rule that recommends focus on the most important aspects of the decision making in order to simplify the process of decision making. It is based on the 80: 20 rule where it is believed that 80% of the profits of an organisation relates to 20% of the customers. It helps to clearly establish top priorities and to identify both profitable and unprofitable targets.
- Usefulness of Pareto Analysis– Prioritize problems, goals, and objectives to identify root causes, define key quality improvement programs, Select key customer relations and service programs, employee relations improvement programs, and key performance improvement programs, proper allocation of physical, financial, and human resources.

- Application of Pareto Analysis– Pricing of a Product, Customer Profitability Analysis, ABC Analysis- Stock Control, Application in Activity Based Costing.
- Life Cycle Costing– Life Cycle Costing involves identifying the costs and revenue over a product's life i.e. from inception to decline. The life cycle of a product consists of four stages viz., Introduction; Growth; Maturity; Saturation and Decline.
- Benefits of Product Life Cycle Costing– Results in earlier actions to generate revenue or to lower costs than otherwise might be considered, more accurate and realistic assessment of revenues and costs, promote long-term rewarding in contrast to short-term profitability rewarding, provides an overall framework for considering total incremental costs over the entire life span of a product, provides long-term picture of product line profitability, enhance the control of manufacturing costs, traces research and design and development costs etc.
- Environmental Management Accounting [EMA] – EMA is the process of collection and analysis of the information relating to environmental cost for internal decision making. EMA identifies and estimates the costs of environment-related activities and seeks to control these costs. The focus of EMA is not on financial costs but it also considers the environmental cost or benefit of any decisions made.
- The major areas for the application for EMA are: Product Pricing, Budgeting, Investment Appraisal, Calculating Costs and Savings of Environmental Projects, or Setting Quantified Performance Targets.
- Environmental Costs–
 - Environmental Prevention Costs-* Pollution Control Equipment, Environmental Policy Formulation, etc.
 - Environmental Appraisal Costs-* Monitoring, Testing and Inspection Costs, Reporting Costs, etc.
 - Environmental Internal Failure Costs-* Cost of Recycling or Disposing of Waste or Harmful Materials, Decommissioning Costs on Project Completion, etc. *Environmental External Failure Costs-* Carbon Emissions and the Adverse Impact these have on the Global Climate.
- Identification of Environmental Costs– Four management accounting techniques for the Identification and Allocation of Environmental Costs are - Input/Outflow Analysis, Flow Cost Accounting, Activity Based Costing and Lifecycle Costing.
 - Input-Output Analysis-*

This technique records material inflows and balances this with outflows on the basis that, what comes in, must go out. By accounting for outputs in this way, both in terms of physical quantities and, at the end of the process, in monetary terms too, businesses are forced to focus on environmental costs.
 - Flow Cost Accounting-*

Classic material flows are recorded as well as material losses incurred at various stages of production.

Life Cycle Costing-

Lifecycle costing considers the costs and revenues of a product over its whole life rather than one accounting period. Therefore, the full environmental cost of producing a product will be taken into account.

Activity Based Costing (ABC) –

ABC distinguishes between environment-related costs, which can be attributed to joint cost centres, and environment- driven costs, which tend to be hidden on general overheads.

- Need to manage Environmental Costs– A ‘carbon footprint’ (as defined by the Carbon Trust) measures the total greenhouse gas emissions caused directly and indirectly by a person, organization, event or product, environmental costs are becoming huge and Such significant costs need to be managed, regulation is increasing worldwide at a rapid pace, with penalties for non-compliance also increasing accordingly.
- Advantages of EMA– Improved Revenues (Production of new products or services meeting the environmental needs or concerns of customers can lead to increased sales) and Cost Reductions (Simple improvements in processes can lead to significant costs savings).
- Disadvantages of EMA– Increases in Costs for legal and regulatory requirements, Costs of Failure if there is poor environmental management.



TEST YOUR KNOWLEDGE

Target Costing

1. Storewell Industries Ltd. manufactures standard heavy duty steel storage racks for industrial use. Each storage rack is sold for ₹750 each. The company produces 10,000 racks per annum. Relevant cost data per annum are as follows:

Cost Component	Budget	Actual	Actual Cost p.a. (₹)
Direct Material	5,00,000 sq. ft.	5,20,000 sq. ft.	20,00,000
Direct Labour	90,000 hrs.	1,00,000 hrs.	10,00,000
Machine Setup	15,000 hrs.	15,000 hrs.	1,50,000
Mechanical Assembly	200,000 hrs.	200,000 hrs.	30,00,000

The actual and budgeted operating levels are the same. Actual and standard rates of material procurement and hourly labor rate are also the same. Any variance in cost is solely on account of difference in the material usage and hours required to complete production. Aggressive pricing from competitors has driven down sales. A comparable rack is available in the market for ₹675 each. Vishal, the marketing manager has determined that in order to maintain the company’s existing market share of 10,000 racks, Storewell Industries must reduce the price of each rack to ₹675.

Required

- (i) CALCULATE the current cost and profit per unit. IDENTIFY the non-value added activities in the production process.
 - (ii) CALCULATE the new target cost per unit for a sales price of ₹675 if the profit per unit is maintained.
 - (iii) RECOMMEND what strategy Storewell Industries should adopt to attain target cost calculated in (ii) above.
2. NEC Ltd., forms a Committee consisting of its Production, Marketing, and Finance Directors to prepare a budget for the next year. The Committee submits a draft budget as detailed below:

Particulars	₹
Selling Price <i>per unit</i>	50
<i>Less: Direct Material Cost per unit</i>	9
Direct Labour Cost <i>per unit</i>	9
Variable Overhead <i>per unit</i> (3 hrs. @ ₹2)	6
Contribution <i>per unit</i>	26
Budgeted Sales Quantity	25,000 units
Budgeted Contribution (25,000 × ₹26)	6,50,000
<i>Less: Budgeted Fixed Cost</i>	5,00,000
Budgeted Profit	1,50,000

The Management is not happy with the budgeted profit as it is almost equal to the previous year's profit. Therefore, it asks the Committee to prepare a budget to earn at least a profit of ₹3,00,000. To achieve the target profit, the Committee reports back with the following suggestions:

The unit selling price should be raised to ₹55.

The sales volume should be increased by 5,000 units.

To attain the above said increase in sales, the company should spend ₹40,000 for advertising.

The production time per unit should be reduced.

To win the acceptance of the workers in this regard the hourly rate should be increased by ₹3 besides an annual group bonus of ₹30,000.

There is no change in the amount and rates of other expenses. The company has sufficient production capacity.

As the implementation of the above proposal needs the acceptance of the work force to increase the speed of work and to reduce the production time per unit, the Board wants to know the extent of reduction in per unit production time.

Required

- (i) CALCULATE the target production time per unit and the time to be reduced per unit.
- (ii) IDENTIFY the other problems that may arise in production due to decrease in unit production time and also suggest the remedial measures to be taken.
- (iii) STATE the most suitable situation for the adoption of Target Costing.

Pareto Analysis

3. Generation 2050 Technologies Ltd. develops cutting-edge innovations that are powering the next revolution in mobility and has nine tablet smart phone models currently in the market whose previous year financial data is given below:

Model	Sales (₹'000)	Profit-Volume (PV) Ratio
Tab - A001	5,100	3.53%
Tab - B002	3,000	23.00%
Tab - C003	2,100	14.29%
Tab - D004	1,800	14.17%
Tab - E005	1,050	41.43%
Tab - F006	750	26.00%
Tab - G007	450	26.67%
Tab - H008	225	6.67%
Tab - I009	75	60.00%

Required

- (i) Using the financial data, carry out a Pareto ANALYSIS (80/20 rule) of Sales and Contribution.
- (ii) DISCUSS your findings with appropriate RECOMMENDATIONS.

Life Cycle Costing

4. P & G International Ltd. (PGIL) has developed a new product 'α³' which is about to be launched into the market. Company has spent ₹30,00,000 on R&D of product 'α³'. It has also bought a machine to produce the product 'α³' costing ₹11,25,000 with a capacity of producing 1,100 units per week. Machine has no residual value. The company has decided to charge price that will change with the cumulative numbers of units sold:

Cumulative Sales (units)	Selling Price ₹ per unit
0 to 2,200	750
2,201 to 7,700	600
7,701 to 15,950	525
15,951 to 59,950	450
59,951 and above	300

Based on these selling prices, it is expected that sales demand will be as shown below:

Weeks	Sales Demand per week (units)
1-10	220
11-20	550
21-30	825
31-70	1,100
71-80	880
81-90	660
91-100	440
101-110	220
Thereafter	NIL

Unit variable costs are expected to be as follows:

₹ per unit	
First 2,200 units	375
Next 13,750 units	300
Next 22,000 units	225
Next 22,000 units	188
Thereafter	225

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

Weeks	Introduction	Growth	
	1 - 10	11 - 30	
Number of units Produced and Sold	2,200	5,500	8,250
Selling Price per unit (₹)	750	600	525
Variable Cost per unit (₹)	375	300	300
Contribution per unit (₹)	375	300	225
Total Contribution (₹)	8,25,000	16,50,000	18,56,250

Required

- (i) PREPARE the total contribution statement for each of the remaining two stages of the product's life cycle.
- (ii) DISCUSS Pricing Strategy of the product 'α³'.
- (iii) FIND possible reasons for the changes in cost during the life cycle of the product 'α³'.

Note: Ignore the time value of money.

5. JFE, is following Life Cycle Costing. Its four products P₄, P₃, P₂ and P₁ are in the market respectively in Introduction, Growth, Maturity, and Decline stages (phases). The Management wants to analyse the marketing challenges faced by the products to take strategical measures to stabilise the products in the market. For this purpose, the Board directed the Secretary to get a product-wise report from the marketing chief of each product. The chiefs were asked to give one characteristic possessed by the product because of which the product is being classified in the respective stage and two strategical measures to be taken to overcome the market challenges faced at that stage (phase). The Secretary received the report from all the chiefs and handed them over to the computer operator to get it printed in a tabulated form. But the operator, without understanding the significance of the products, phases, characteristics, and strategies, mixed all the twelve items [(1 + 2) × 4] and got it printed as a list as given below:

- (1) Over capacity in the industry.
- (2) The company can continue to offer the product to our loyal customers at a reduced price.
- (3) Few competitors produce basic version of our product.
- (4) Product features may be improved or enhanced to differentiate our product from that of the competitors.
- (5) Attracting customers by raising awareness about our product through promotion activities.
- (6) High volume of business and increase in competition.
- (7) Use the present product as replacement product for launching another new product successfully in the market.
- (8) Value-based pricing strategies may be considered.
- (9) Profits start declining and at times become negative.
- (10) Maintain control over product quality to assure customer satisfaction.
- (11) Strengthening or expanding channel and supply chain relationships.
- (12) Prices may have to be reduced to attract the price-sensitive customers.

The items are required to be tabulated as in the format given below:

Required

- (i) Complete the table given below by entering the twelve items under appropriate category columns. You need not rewrite the items. Write the serial numbers of the items only in columns (3) and (4).

Products (1)	Phases (Stages) (2)	Characteristics (3)	Strategies (4)
P ₄	Introduction		
P ₃	Growth		
P ₂	Maturity		
P ₁	Decline		

- (ii) List down the importance (any four) of Product Life Cycle Costing.
 (iii) State the benefits (any four) of Product Life-Cycle Costing.

Environmental Management Accounting

6. A fertilizer company produces Grade A and Grade B fertilizers. One kilogram of Grade A fertilizer sells for ₹280 per kilogram and one kilogram of Grade B fertilizer sells for ₹400 per kilogram.

The products pass through three cost centers CC1, CC2 and CC3 during the manufacturing process. Total direct material cost per kilogram of fertilizer produced is ₹300 and direct labor cost per kilogram of fertilizer produced is ₹200. Allocation between the cost centres is given below:

Particulars	CC1	CC2	CC3	Total
Cost of Direct Material (per kg of fertilizer produced)	₹90	₹120	₹90	₹300
Cost of Direct Labour (per kg of fertilizer produced)	₹60	₹80	₹60	₹200
Cost Allocation to Grade A	30%	50%	30%	
Cost Allocation to Grade B	70%	50%	70%	

All of expenses (considered to be overheads) per kilogram of fertilizer produced is ₹150. This is allocated equally between Grade A and Grade B fertilizer. Pricing decisions for the fertilizers is made based on the above cost allocation.

The management accountant of the company has recently come across the concept of environmental management accounting. Pricing of products should also factor in the environmental cost generated by each product. An analysis of the overhead expenses revealed that the total cost of ₹150 per kilogram of fertilizer produced, includes incinerator costs of ₹90 per kilogram of fertilizer produced. The incinerator is used to dispose the solid

waste produced during the manufacturing process. Below is the cost center and product wise information of solid waste produced:

Waste produced (in tonnes per annum)	CC1	CC2	CC3	Total
Grade A	2	3	1	6
Grade B	2	2	5	9

Based in the impact that each product has on the environment, the management would like to revise the cost allocation to products based taking into account the incinerator cost that each product generates. The remaining overhead expenses of ₹60 per kilogram of fertilizer produced can be allocated equally.

Required

- (i) CALCULATE product wise profitability based on the original cost allocation. RECALCULATE the product wise profitability based on activity based costing methodology (environmental management accounting).
- (ii) ANALYZE difference in product profitability as per both the methods.
- (iii) RECOMMEND key takeaways for the company to undertake the above analysis of overhead costs and pricing as per environmental management accounting.



ANSWERS/ SOLUTIONS

1. (i) The current cost and profit per unit are calculated as below:

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

Therefore, the current cost is ₹615 p.u. while the profit is ₹135 p.u. Machine setup is the time required to get the machines and the assembly line ready for production. In this case, 15,000 hours spent on setting up does not add value to the storage racks directly. Hence, it is a non-value add activity.

- (ii) New sale price per rack is ₹675 per unit. The profit per unit needs to be maintained at ₹135 per unit. Hence, the new target cost per unit = new selling price per unit – required profit per unit = ₹675 - ₹135 = ₹540 per unit.

- (iii) As explained above, current cost per unit is ₹615 while the target cost per unit is ₹540. Hence, the cost has to be reduced at least by ₹75 per unit. Analysis of the cost data shows the variances between the budget and actual material usage and labor hours. It is given that the material procurement rate and labor hour rate is the same for budgets and actuals. Hence, the increment in cost of direct materials and labor is due to inefficient use of material and labor hours to complete the same level of production of 10,000 storage racks.

Corrective actions to address these inefficiencies could result in the following savings:

- (a) Inefficiencies resulted in use of extra 20,000 sq. ft. of material.

Material cost per sq. ft. = Actual cost / Actual material usage = ₹20,00,000 / 5,20,000 sq. ft. = ₹3.85 per sq. ft.

Therefore, inefficiencies resulted in extra cost = 20,000 sq. ft. × ₹3.85 per sq. ft. = ₹77,000.

If corrective action is taken, for 10,000 racks this translates to a saving of ₹7.70 per unit.

- (b) Inefficiencies resulted in extra 10,000 hrs. to be spent in production.

Labor cost per hr. = Actual cost / Actual labor hrs. = ₹10,00,000 / 10,000 hrs. = ₹10 per hr.

Therefore, inefficiencies resulted in extra cost = 10,000 hrs. × ₹10 per hour = ₹100,000.

If corrective action is taken, for 10,000 racks this translates to a saving of ₹10 per unit.

- (c) Machine setup cost is a non-value added cost. Value analysis can be done to determine if the setup time of 15,000 hrs. can be reduced. However, since these activities have been carried out for a reason, care should be taken to ensure that this change should not adversely impact the production activity later down the stream.

- (d) Mechanical assembly cost is almost half of the total cost. These are costs incurred during the production process on the assembly line. Value analysis can be done to determine if the production process can be made more efficient. For example, the process can be streamlined, such that steps can be combined that can be handled by fewer people (process centering). Similarly, value analysis / value engineering can focus on the product design.

Some questions to raise may be:

- Can the product be designed better to make the production more efficient?
- Can the design be minimized to include fewer parts and thus make it easier and efficient to manufacture?

- Can be substitute parts to make it more efficient? Or
- Is there simply a better way of producing the same product?

While target costing is a dynamic and corrective approach, care must be taken the product quality, characteristics and utility are maintained.

2. (i) Target Production Time *per unit*
- | | |
|---|-----------------------|
| $(₹3 + ₹3 + ₹2) \times \text{hrs.} \times 30,000 \text{ units}$ | = ₹5,10,000 |
| Hrs. | = 2.125 |
| Time to be reduced <i>per unit</i> | = 3 hrs. – 2.125 hrs. |
| | = 0.875 hrs. |

Workings

Statement Showing Target Cost (Direct Labour and Variable Overhead)

Particulars	Amount (₹)
Target Sales ($₹55 \times 30,000 \text{ units}$)	16,50,000
Less: Target Profit	3,00,000
Less: Direct Material Cost ($₹9 \times 30,000 \text{ units}$)	2,70,000
Less: Budgeted Fixed Costs	5,00,000
Less: Proposed Advertising	40,000
Less: Proposed Annual Group Bonus	30,000
Target Cost (Variable Overhead and Direct Labour) for 30,000 units	5,10,000

(ii) Problem

The target-costing method is applicable particularly for repetitive manufacturing. It should however be recognised that some products often bear a high degree of repetition and that there often are considerable repetitions where reduction targets could come into play as a framework for improving design. Working under pressure to finish new design assignments in a short time may take development resources away from efforts to optimise or re-engineer production processes. If approaching product design as an activity to be optimised independently there is a risk that target costing may not succeed to satisfactorily addressing overall performance, so in short decrease in unit production time may lead to unwanted pressure on design and its implementation stage.

Remedial Measures

As a remedial action organisation should retain strong control over the design teams headed by a good team leader. This person must have an exceptional knowledge of the design process, good interpersonal skills, and a commitment to staying within both time and cost budgets for a design project. If the time is too short even an organisation may

reject a project for the time being. Later, it can be tried out with new cost reduction methods or less expensive materials to achieve target cost and control overall production activities.

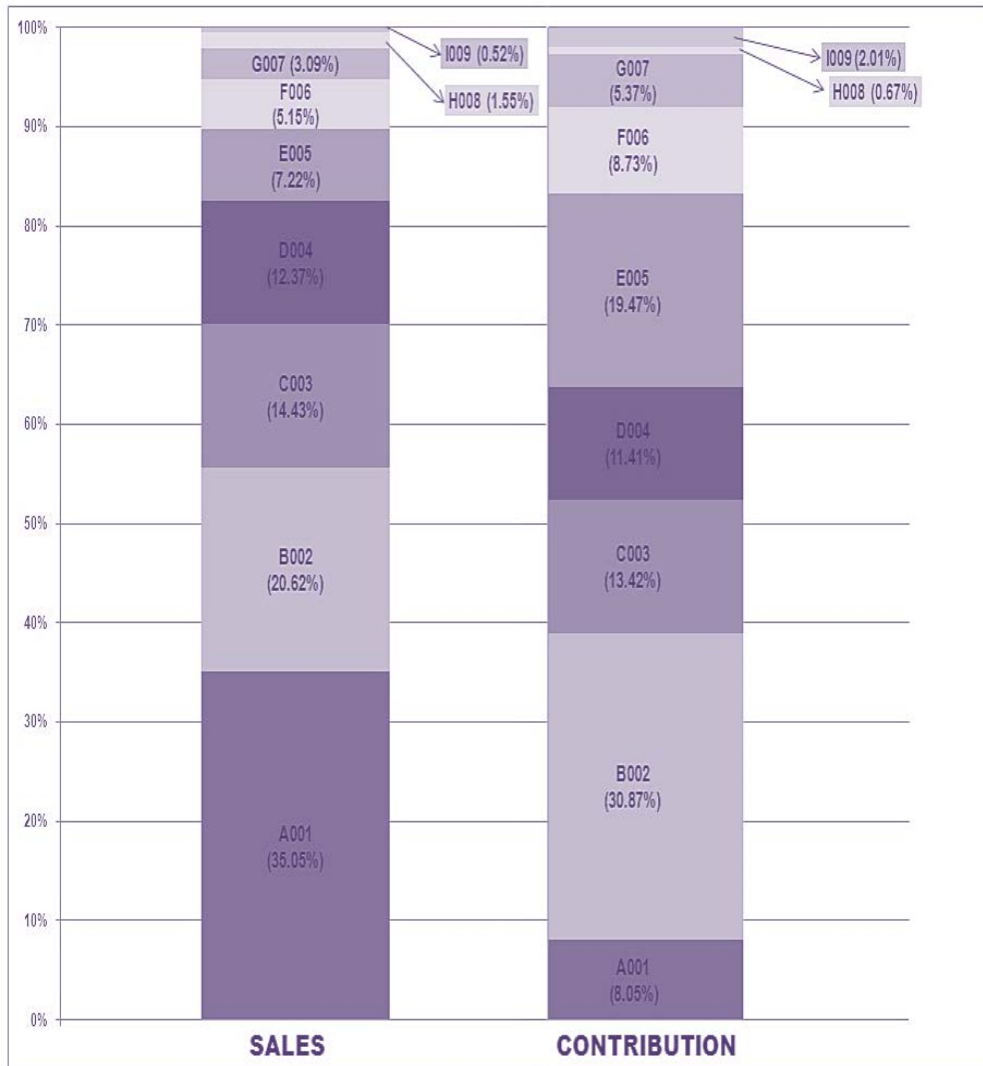
- (iii) Target costing is most useful in situations where *the majority of product costs are locked in during the product design phase*. This is the case for most manufactured products, but few services. In the services area, such as consulting, the bulk of all activities can be reconfigured for cost reduction during the “production” phase, which is when services are being provided directly to the customer. In the services environment, the “design team” is still present but is more commonly concerned with streamlining the activities conducted by the employees providing the service, which can continue to be enhanced at any time, not just when the initial services process is being laid out.

3. “Pareto Analysis”

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

(*) Rounding - off difference adjusted.

Diagram Showing “Sales and Contribution”



Recommendations

Pareto Analysis is a rule that recommends focus on most important aspects of the decision making in order to simplify the process of decision making. The very purpose of this analysis is to direct attention and efforts of management to the product or area where best returns can be achieved by taking appropriate actions.

Pareto Analysis is based on the 80/20 rule which implies that 20% of the products account for 80% of the revenue. But this is not the fixed percentage rule; in general business sense, it means that a few of the products, goods or customers may make up most of the value for the firm.

In present case, five models namely A001, B002, C003, D004 account for 80% of total sales where as 80% of the company's contribution is derived from models B002, E005, C003, D004 and F006.

Models B002 and E005 together account for 50.34% of total contribution but having only 27.84% share in total sales. So, these two models are the key models and should be the top priority of management. Both C003 and D004 are among the models giving 80% of total contribution as well as 80% of total sales so; they can also be clubbed with B002 and E005 as key models. Management of the company should allocate maximum resources to these four models.

Model F006 features among the models giving 80% of total contribution with relatively lower share in total sales. Management should focus on its promotional activities.

Model A001 accounts for 35.05% of total sales with only 8.05% share in total contribution. Company should review its pricing structure to enhance its contribution.

Models G007, H008 and I009 have lower share in both total sales as well as contribution. Company can delegate the pricing decision of these models to the lower levels of management, thus freeing themselves to focus on the pricing decisions for key models.

4. (i) Total Contribution Statement

“Total Contribution- for remaining two stages”

Particulars	Maturity		Decline
	31 - 50	51 - 70	
Weeks	31 - 50	51 - 70	71 - 110
Number of units Produced and Sold	22,000	22,000	22,000
Selling Price per unit (₹)	450	450	300
Less: Unit Variable Cost (₹)	225	188	225
Unit Contribution (₹)	225	262	75
Total Contribution (₹)	49,50,000	57,64,000	16,50,000

(ii) Pricing Strategy for Product α^3

PGIL is following the skimming price strategy that's why it has planned to launch the product α^3 initially with high price tag.

A skimming strategy may be recommended when a firm has incurred large sums of money on research and development for a new product.

In the problem, PGIL has incurred a huge amount on research and development. Also, it is very difficult to start with a low price and then raise the price. Raising a low price may annoy potential customers.

Price of the product α^3 is decreasing gradually stage by stage. This is happening because PGIL wants to tap the mass market by lowering the price.

(iii) Possible Reasons for the changes in cost during the life cycle of the product ' α^3 '

Product life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle. Possible reasons for the changes in cost during the life cycle of the product are as follows:

PGIL is expecting reduction in unit cost of the product α^3 over the life of product as a consequence of economies of scale and learning / experience curves.

Learning effect may be the possible reason for reduction in per unit cost if the process is labour intensive. When a new product or process is started, performance of worker is not at its best and learning phenomenon takes place. As the experience is gained, the performance of worker improves, time taken per unit reduces and thus his productivity goes up. The amount of improvement or experience gained is reflected in a decrease in cost.

Till the stage of maturity, PGIL is in the expansion mode. The PGIL may be able to take advantages of quantity discount offered by suppliers or may negotiate the price with suppliers.

Product α^3 has the least variable cost ₹188 in last phase of maturity stage; this is because a product which is in the mature stage may require less marketing support than a product which is in the growth stage so, there is a saving of marketing cost per unit.

Again, the cost per unit of the product α^3 jumps to ₹225 in decline stage. As soon as the product reaches its decline stage, the need or demand for the product disappear and quantity discount may not be available. Even PGIL may have to incur heavy marketing expenses for stock clearance.

Workings

Cumulative Sales along with Sales Price and Variable Cost

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

81 - 90	660	6,600	75,350	300	225
91 - 100	440	4,400	79,750	300	225
101 - 110	220	2,200	81,950	300	225

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

Products (1)	Phases (Stages) (2)	Characteristics (3)	Strategies (4)
P ₄	Introduction	(3)	(5), (11)
P ₃	Growth	(6)	(10), (8)
P ₂	Maturity	(1)	(4), (12)
P ₁	Decline	(9)	(2), (7)

(ii) **Importance of Product Life Cycle (PLC) Costing**

- As a Planning tool, it characterizes the marketing challenges in each stage and poses major alternative strategies, i.e. application of Kaizen.
- As a Control tool, the PLC concept allows the company to measure product performance against similar products launched in the past.
- As a Forecasting tool, it is very important because sales histories exhibit diverse patterns and the stages vary in duration.
- It leads to appropriate strategy formulation depending on the stages of the product life cycle.

(iii) **Benefits of Product Life Cycle Costing**

The benefits of product life cycle costing are summarized as follows:

- The product life cycle costing results in *earlier actions to generate revenue or to lower costs* than otherwise might be considered. There are a number of factors that need to be managed in order to maximize return on a product.
- Better decisions should follow from a *more accurate and realistic assessment of revenues and costs*, at least within a particular life cycle stage.
- Product life cycle thinking can promote *long-term rewarding* in contrast to short-term profitability rewarding.
- It provides an *overall framework for considering total incremental costs over the entire life span of a product*, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.
- It is an approach used to provide a *long-term picture of product line profitability*, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.

- It is also considered as a way to enhance the *control of manufacturing costs*. The thrust of product life cycle costing is on the distribution of costs among categories changes over the life of the product, as does the potential profitability of a product. Hence it is important to track and measure costs during each stage of a product's life cycle.
- Product life cycle costing *traces research and design and development costs* etc., incurred to individual products over their entire life cycles, so that the total magnitude of these costs for each individual product can be reported and compared with product revenues generated in later periods.

6. (i) Product Wise Profitability as per Original Allocation Methodology

(Figures in ₹ per kilogram of fertilizer produced)

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

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

Particulars	CC1			CC2			CC3			Total for the company		
	A	B	CC Total	A	B	CC Total	A	B	CC Total	Gr. A	Gr. B	Grand Total
Direct Material	27	63	90	60	60	120	27	63	90	114	186	300
Direct Labour	18	42	60	40	40	80	18	42	60	76	124	200



Product Wise Profitability (activity based costing using environmental management accounting) requires the following **steps**:

1. Overhead expenses of ₹ 150 per kilogram of fertilizer produced be first bifurcated into incinerator costs and other overhead costs.
2. Incinerator costs of ₹ 90 per kilogram of fertilizer needs to be allocated first to the cost centres. This is done based on the waste generated at each cost centre. The individual cost allocated to each cost centre is again allocated to products based on the waste generated at each cost centre by each product. Refer part a of table 2 for detailed calculations.
3. As mentioned in the problem, other overhead costs are allocated to each product at each cost centre level equally. Refer part b of table 2 for detailed calculations.
4. The above allocations to each product at a cost centre level is then summed up to get the product wise overhead cost allocation. Refer part c of table 2 for detailed calculations.

Accordingly, the **Revised Product Profitability** would be as follows:

(Figures in ₹ per kilogram of fertilizer produced)

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

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

(Figures in ₹ per kilogram of fertilizer produced)

Product Waste Produced (in tonnes per annum)	CC1	CC2	CC3	Total
Grade A	2	3	1	6
Grade B	2	2	5	9
Total Waste (in tonnes)	4	5	6	15
Incinerator Cost Allocated to Cost Centres (based on waste generated)	24	30	36	90
Other Overhead Expenses	20	20	20	60
Total Cost Centre Wise Overhead Cost	44	50	56	150

Part A: Allocation of Incinerator Cost from Cost Centre to each product <i>(based on waste produced at each cost centre by each product)</i>				
Product	CC1	CC2	CC3	Total
Grade A	12	18	6	36
Grade B	12	12	30	54
Total Incinerator Cost	24	30	36	90
Part B: Allocation of Other Overhead Cost from Cost Centre to each product				
Product	CC1	CC2	CC3	Total
Grade A	10	10	10	30
Grade B	10	10	10	30
Total Other Overhead Cost	20	20	20	60
Part C: Total Overhead Cost (Cost Centre and Product Wise i.e. part a + b)				
Product	CC1	CC2	CC3	Total
Grade A	22	28	16	66
Grade B	22	22	40	84
Total Overhead Cost	44	50	56	150

Summarizing Product Profitability as per both methods:

Product	(Profit in ₹ per kg of fertilizer produced)		Profit %	
	Original Method	ABC (as per EMA) Method	Original Method	ABC (as per EMA) Method
Grade A	15	24	5.36%	8.57%
Grade B	15	6	3.75%	1.50%

- (ii) As summarized above, originally the profit generated from Grade A and Grade B products, was ₹15 per kilogram. Grade A was the more profitable product giving return of 5.36% compared to Grade B's return of 3.75%. This has been calculated by allocating overheads equally to Grade A and B.

During the year, 15 tons of waste is produced during the manufacturing process. Grade B fertilizer produces more waste that accounts for 60% of the waste. Therefore, Grade B should bear higher amount of the incinerator cost compared to Grade A. Allocation based on this premise, dramatically changes the profitability of the products. As calculated above, Grade A fertilizer, due to lower incinerator cost allocation, generates a profit of ₹24 per kilogram of fertilizer. Grade B's profits accordingly are lower, since the product generates more waste and has to bear a larger share of clean-up expenses. Profitability of Grade A increases to 8.57% while Grade B falls dramatically to 1.50%.

- (iii) The company can draw a number of conclusions from this analysis of overhead costs as per environmental management accounting. This analysis has helped the company reach the conclusion that Grade B fertilizer produces more waste. The company could adopt either of the following approaches:
- (a) To maintain the same level of profitability, the company can increase the price of Grade B by another ₹9 per kilogram. This is a 2.25% increase in the sale price of Grade B fertilizer. Depending on the market for this grade of fertilizer, the company has to decide whether to increase the price of the product. While a price increase may be possible if the company has a strong market hold, it might be difficult if competition in the market is high. or
 - (b) The other approach, a more sustainable approach that is the aim of environmental management accounting, would be to reduce the waste produced in the manufacturing process. This analysis, has quantified the waste generated in the process. Better manufacturing techniques, could save the company incinerator costs, that would yield better profits for the company.