ICAI Solutions

Illustration

1 Target Costing
2 Target Costing with LC
3 Life Cycle Costing
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5 Pareto Analysis
6 Environment Mgt Accounting

Test Your Knowledge

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Pareto Analysis

Q 1 Illu 5
Q 2 Tyk 2
Q 3 Tyk 3

Life Cycle Costing

Q 4 Illu 3
Q 5 Illu 4
Q 6 Tyk 4
Q 7 Tyk 5
Q 8 Tyk 6

Target Costing

Q 9 Illu 1
Q 10 Tyk 2

Environment Mgt Accounting

Q 11 Illu 6
Q 12 Tyk 8
Q 13 Tyk 7

Target Costing with LC

Q 14 Illu 2

Q 1
Q 2
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Q1

Illustration 5

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 Instances*
End Frame not equidistant from the center	*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 colour-shade differences	*25*

Required

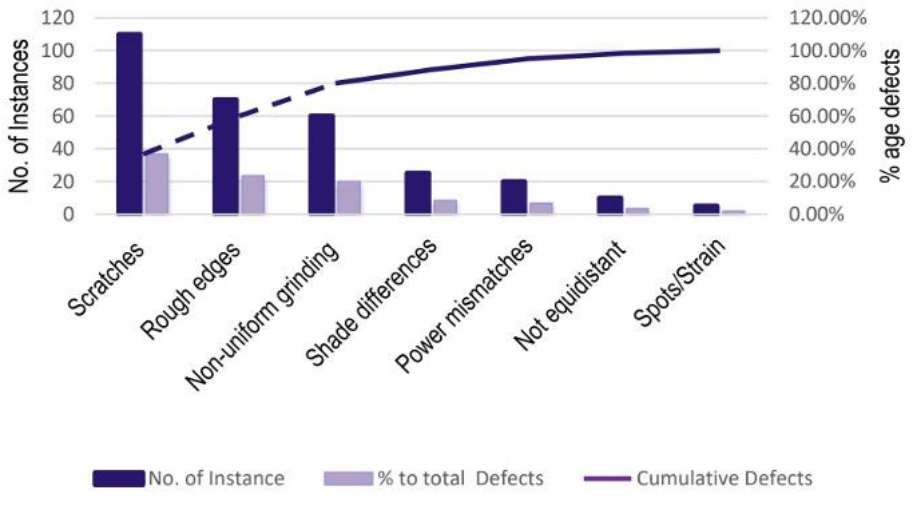
PREPARE a frequency table to construct Pareto Chart for the defect type. Also, IDENTIFY key areas (vital few) of focus and highlight them in the graph too.

Solution

Statement Showing "Pareto Analysis of Defects"

Defect Type	No. of Instances	% to total Defects	Cumulative Defects
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 center	10	3.33%	98.33%
Spots/ Strain on lenses	5	1.67%	100.00%
	300	100.00%	

The company should focus on the elimination of scratches on the surface, rough edges of lenses, and non-uniform grinding of lenses (**in priority order**), because they constitute 80% of instances when defect found in any item.



Q2

2. 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.

Solution

"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.*

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, four models namely A001, B002, C003, D004 account for around 80% (82.47%) of total sales whereas around 80% (83.90%) of the company's contribution is derived from five models namely 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.

Q3

3. The information given below pertains to ABC Enterprises, a specialized car garage door installation company. ABC Enterprises use to get multiple service calls from the customers with variety of requirements. They may have to Install, Replace, Adjust or Lubricate some part or other to make the door functional. They work with 5 major parts as given in the table, namely Door, Motor, Track, Trimmer and T -Lock.

Sr.No.	Parts	Type of Service				Total
		Install	Replace	Adjust	Lubricate	
1	Door	2	5	1	0	**8**
2	Motor	3	2	16	9	**30**
3	Track	5	0	6	6	**17**
4	Trimmer	14	6	0	0	**20**
5	T-Lock	5	0	1	0	**6**
6	Miscellaneous	0	2	1	1	**4**
	Total	**29**	**15**	**25**	**16**	**85**

Required

(i) Using the above data, carry out a Pareto Analysis (80/20 rule) of Total Parts.

(ii) Using the same data carry out the second level Pareto Analysis on the type of services with respect to Motors only.

(iii) Give your RECOMMENDATIONS on the basis of your calculations in (i) and (ii) above.

(Do calculations to two decimals only)

Solution

(i) Statement Showing "Pareto Analysis of Total Parts"

Parts	No. of Items	% of Total Items	Cumulative Total
Motor	30	35.29	35.29%
Trimmer	20	23.53	58.82%
Track	17	20.00	78.82%
Door	8	9.41	88.23%
T-Lock	6	7.06	95.29%
Miscellaneous	4	4.71	100.00%

(ii) Statement Showing "Pareto Analysis of Type of Services (Motor)"

Type of Services	No. of Items	% of Total Items	Cumulative Total
Adjust	16	53.33	53.33%
Lubricate	9	30.00	83.33%
Install	3	10.00	93.33%
Replace	2	6.67	100.00%
	30		

(iii) 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 area where best pay-off 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.

The present case stands in a difference to 80/20 rule. Because the company installs doors, they sometimes have multiple service calls to install each door piece by piece. They may have to install, replace, adjust, or lubricate some part to get the door working properly. They work with five main parts: door, motor, track, trimmer and t-lock. The service calls with reference to motors are heavy and accounted for as much as 35.29% of the number of calls attended. Motor together with trimmer accounted for 58.82%. So, these two parts are to be considered as key parts and ABC enterprises must be ever ready to cater to all provisional requirements for attending these classes without any inordinate delay. Any delay in service these calls is likely to damage its service rendering reputation within a very short span of time. Further, the second level Pareto Analysis on motors has revealed a particular reference to the service problems related to motors. Adjustments and Lubrication issues cover up 83.33% of the total service problems exclusively connected to Motors. So, ABC Enterprise must direct its best efforts and develop specific expertise to solve these problems in the best interest of the customers.

Q4

Illustration 3

In WM Ltd. the 'OB' equipment is about to be replaced either by 'CF' system or by an 'OF' system. Finance costs 12% a year and the other estimated costs are as follows:

	CF (₹)	OF (₹)
Initial Cost	*28,000*	*40,000*
Annual Operating Costs	*24,000 p.a.*	*18,000 p.a.*

Required

If the company expected the new system (either CF or OF) to last at least for 12 years, which system should be chosen? COMMENT.

Solution

Calculation of Life-cycle Costs

	CF (₹)	OF (₹)
Initial Cost	28,000	40,000
Add: Present value of annual operating costs over the life-time	1,48,656 (₹ 24,000 x 6.194)	1,11,492 (₹ 18,000 x 6.194)
Total Life Cycle Costs	1,76,656	1,51,492

The annuity factor of 12% finance costs for 12 years is 6.194.

Analysis

When we compare only the initial cost, we will tend to purchase CF system, for its cheap acquisition cost. But when we compare the total life-cycle costs, the OF system is most preferable, for its lowest total life-cycle costs.

Q5

Illustration 4

Lite Limited willing to inculcate life cycle costing in its costing system. Product manager define the phases of the product as Design, Manufacturing, Operations, and End of life; Can you assist the management accountant to LIST the type of cost which will be significantly incurred at Lite limited under identified four phases?

Solution

Although the four phases are Introduction, Growth, Maturity, and Decline, It may be possible for any organisation to customise the model as per their need and wisdom to analyse the cost and corresponding revenue over the life of the product.

Type of Costs, Lite Limited is expected to incure during different stages

Phase/Stage	Cost
Design	Research, Development, Design & Testing
Manufacturing	Material, Labour, Overheads, Machine Set-up, Inventory, Training, Production Machine, Maintenance, and Depreciation
Operation	Distribution, Advertising, and warranty claims
End of Life	Environmental Clean-up, Disposal and Discommissioning

Note *– The above categorisation of cost is purely based upon significance %age of the cost incurred, it may possible that certain category of the cost incurred over more than one phase of the life cycle. For example, product development cost needs to be incurred in each phase till maturity phase, earlier for creation and then for differentiation (even in decline phase too with intent to product extension)*

Q6

4. Tt Co. Ltd. makes digital watches. The company is preparing a product life cycle budget for a new watch. Development on the new watch is to start shortly. Estimates for new watch are as under:

Life Cycle Units Manufactured and Sold	2,40,000	***Marketing Costs:***	
Selling Price Per Watch	₹500	Variable Cost Per Batch	₹24
Life Cycle Costs:		Watches Per Batch	96
R&D and Design Cost	₹80 Lakh	Fixed Costs	₹8 Lakh
Manufacturing Costs:		***Distribution Costs:***	
Variable Cost Per Watch	₹120	Variable Cost Per Watch	₹240
Variable Cost Per Batch	₹4,000	Fixed Costs	₹45 Lakh
Watches Per Batch	300	***Customer Service Cost:***	
Fixed Costs	₹112 lakh	Variable Cost Per Watch	₹10

Required

(i) CALCULATE the budgeted life cycle operating income for the new watch.

(ii) COMPUTE % of budgeted total product life-cycle costs incurred till the R & D and design stages.

(iii) ADVISE the strategies to be adopted by the Tt Co. Ltd. to develop a new watch.

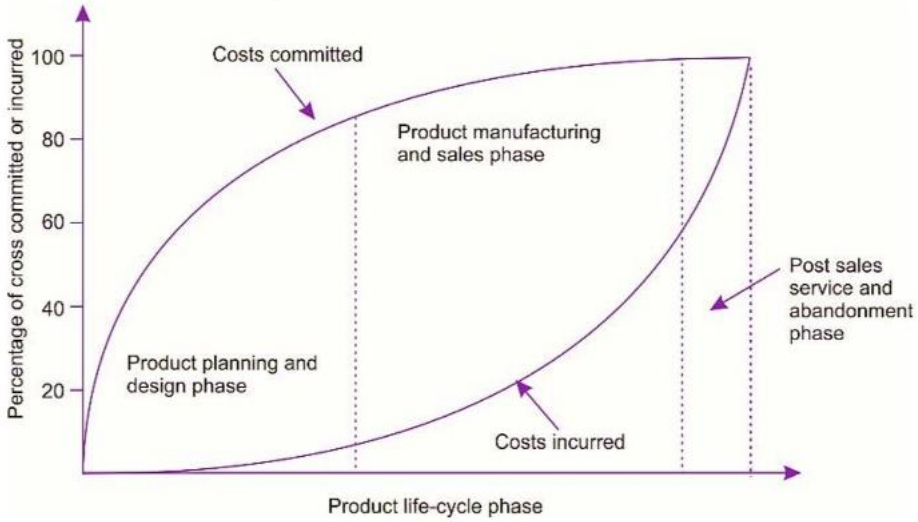
(i) Statement Showing Budgeted Life-Cycle Operating Income

Particulars	**(₹)**
Revenues (₹500 × 2,40,000 units)	12,00,00,000
Less: R&D and Design Costs	80,00,000
Manufacturing Costs:	
Variable (₹120 × 2,40,000 units)	2,88,00,000
Batch $\left(2,40,000 \times \frac{₹4,000}{3,000}\right)$	32,00,000
Fixed	1,12,00,000
Marketing Costs:	
Batch $\left(2,40,000 \times \frac{₹24}{96}\right)$	60,000
Fixed	8,00,000
Distribution Costs:	
Variable (₹240 × 2,40,000)	5,76,00,000
Fixed	45,00,000
Customer Service Costs:	
Variable (₹10 × 2,40,000)	24,00,000
Total Costs	11,65,60,000
Operating Income	34,40,000

(ii) % of Budgeted Total Product Life-Cycle Costs incurred till the R & D and Design Stages:

$$\left(\frac{₹80,00,000}{₹11,65,60,000}\times 100\right)=6.86\%$$

(iii) We can see from the below figure that approximately 80% of a product's cost are committed during the planning and design stage. At this stage product designers determine the product's design and the production process. In contrast, the majority of costs are incurred at the manufacturing stage, but they have already become locked in at the planning and design stage and are difficult to alter.



The pattern of cost commitment and incurrence will differ based on the industry and specific product introduced. For developing a watch, Tt Co. Ltd. needs to incur only ₹80 lacs for its R&D and design Cost. So, Cost Management of Tt Co. Ltd can be most effectively exercised during the planning and design stage of its new watch and not at the manufacturing stage when the product design and processes have already been determined and costs have been committed. At manufacturing stage only cost containment is possible rather than on cost management. An understanding of life-cycle costs and how they are committed and incurred at different stages throughout a product's life cycle of the watch will also led to the emergence of target costing, a technique that focuses on managing costs during a product's planning and design phase.

Q7

5. Mould & Dies (M&D) was established in 1980 and has enormous wealth of experience in the mould manufacturing industry and serves wide range of plastic moulds all over nation. Over the past decade, M&D has developed the reputation for quality products & services for customer focused approach. It deals in injection moulds, blow moulds, die sets, moulds base etc.

With a state-of-the-art infrastructure facility, M&D is able to meet the qualitative and quantitative demands of its clients. Its vision & mission is to provide high class manufactured products by using best quality raw materials.

M&D has developed a new product "M" which is about to be launched into the market and anticipates to sell 80,000 of these units at a sales price of ₹ 300 over the product's life cycle of four years. Data pertaining to product "M" are as follows:

Costs of Design and Development of Molds, Dies, and Other Tools	₹ 8,25,000
Manufacturing Costs	₹ 125 per unit
Selling Costs	₹ 12,500 per year + ₹ 100 per unit
Administration Costs	₹ 50,000 per year
Warranty Expenses	5 Replacement Parts per 25 units at ₹ 10 per part; 1 Visit per 500 units (Cost ₹ 500 per visit)

Required

(i) COMPUTE the product "M"'s 'Life Cycle Cost'.

(ii) SUGGEST two ways to maximize "M''s lifecycle return.

Note: *Ignore time value of money*

(i) Statement Showing "M's Life Cycle Cost (80,000 units)"

Particulars	Amount (₹)
Costs of Design and Development of Molds, Dies, and Other Tools	8,25,000
Manufacturing Costs (₹125 × 80,000 units)	1,00,00,000
Selling Costs (₹100 × 80,000 units + ₹12,500 × 4)	80,50,000
Administration Costs (₹50,000 × 4)	2,00,000
Warranty	
(80,000 units / 25 units × 5 parts × ₹10)	1,60,000
(80,000 units / 500 units × 1 visit × ₹500)	80,000
Total Cost	1,93,15,000

(ii) Following ways are suggested to maximize "M" lifecycle return:

R&D Costs

Often **significant part of cost (even above 80%) is committed at the R&D phase of new product**, hence M&D should carefully plan and design its new product "M" as it will determine the number of parts, production process to be used etc. M&D can apply ***value engineering*** here. It involves improving product quality, reducing product costs, fostering innovation, eliminating unnecessary and costly design elements, ensuring efficient investment in product, and developing implementation procedures. Value engineering is most successful when it is performed early in product development stage. A value engineering study should be performed within the first 25-30% of the design effort prior to selecting the final design alternative. Here, it is also important that R&D team should work as a part of cross functional team i.e. (participate in a group of people from different functional areas), to minimise lifecycle cost and the production cycle time in new development.

Speed up the Product Launch

In cut throat competitions, it is important for M&D to get new product 'M' launch into the market as soon as possible since this will give "M" a ***long stay*** in the market place *without competition* in the market. Competitor always try to launch a rival product as quickly as possible in order to gain 'competitive edge'. M&D may lose overall profitability if it delays in launching of Product 'M'. It is usually worthwhile incurring extra costs to keep the launch on schedule or to speed up the launch.

Q8

6. P & G International Ltd. (PGIL) has developed a new product 'α^3' which is about to be launched into the market. Company has spent ₹30,00,000 on R&D of product 'α^3'. It has also bought a machine to produce the product 'α^3' 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 'α^3' for its Introduction and Growth stage:

	Introduction	Growth	
Weeks	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 'α^3'.

(iii) FIND possible reasons for the changes in cost during the life cycle of the product 'α^3'.

Note: Ignore the time value of money.

(i) Total Contribution Statement

"Total Contribution- for remaining two stages"

Particulars	Maturity		Decline
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

Q9

Illustration 1

Kowloon Toy Company (KTC) expects to successfully launch Toy "H" based on a Disney character. KTC must pay a 15% royalty on the selling price to 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 to the above, 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

Currently expected cost is ₹63 against the target cost of ₹60. Company KTC should make efforts to **reduce the cost of H by ₹ 3** to achieve a target selling price of ₹100.

Q10

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.

Solution

(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 the taken the product quality, characteristics and utility are maintained.

Q11

Illustration 6

A chemical company produces two chemicals SX and ZX. Environmental activities and costs associated with the two chemicals are as follows;

	SX	ZX
Unit produced (kg.)	*6,00,000*	*15,00,000*
Packing Materials (kg.)	*80,000*	*40,000*
Energy Usage (KWH)	*60,000*	*30,000*
Toxin releases (Pounds into the air)	*2,00,000*	*40,000*
Pollution control machine hours	*32,000*	*8,000*

Cost of environmental activities:

Packing material Costs	*₹ 3,60,000*
Energy Costs	*₹ 96,000*
Fines for release of toxins into the air	*₹ 48,000*
Operating costs of pollution control equipment	*₹ 1,12,000*

Required

CALCULATE the environmental cost per kilogram for each chemical produced by the company.

Solution

Environment costs can be allocated to Chemicals SX and ZX using Activity Based Costing.

Sr. No.	Type of Environment cost	Allocation Basis	Cost Allocation ₹		
			Chemical SX	Chemical ZX	Total
1.	Packing Material Costs	Packing Materials (kg.) SX 80,000 kg. ZX 40,000 kg.	2,40,000	1,20,000	3,60,000
2.	Energy Cost	Energy Usage (KWH) SX 60,000 kwh ZX 30,000 kwh	64,000	32,000	96,000
3.	Fines for Release of Toxins into Air	Toxins Released (Pounds into air) SX 200,000 pounds ZX 40,000 pounds	40,000	8,000	48,000
4.	Operating Costs of Pollution Control Equipment	Pollution Control Machine Hours SX 32,000 hrs. ZX 8,000 hrs.	89,600	22,400	1,12,000
5.	Total Cost Allocation	Sum of Steps 1 to 4	4,33,600	1,82,400	6,16,000
6.	Units Produced (kg.)		6,00,000	15,00,000	21,00,000
7.	Environment Cost per unit produced (Step 5 / Step 6)		**₹ 0.7227**	**₹ 0.1216**	₹ 0.2933

The environment cost allocation per kilogram for Chemical SX is ₹0.7227 per kg and Chemical ZX is ₹0.1216 per kg.

The average environment cost per kg for overall production is ₹0.2933 per kg.

Q12

8. "QR" Ltd. is the leading manufacturer and exporter of high quality leather products - Product Q and Product R.

Selling price per unit of Product Q and Product R is ₹620 and ₹420 respectively.

Both the products pass through three processes - Tanning, Dyeing and Finishing during manufacturing process. Allocation of costs per unit of leather products manufactured among the processes are given below:

Particulars	Tanning	Dyeing	Finishing	Total
Direct Materials Cost ₹ *per unit*	140	180	140	460
Direct Labour Cost ₹ *per unit*	90	120	90	300
Cost allocation to Product Q	70%	50%	70%	
Cost allocation to Product R	30%	50%	30%	

General overheads per unit of leather products Q or R manufactured are ₹115. This blanket absorption rate is derived after division of total general overhead with number of leather product be it Q or R. Above cost allocation is the basis for the decisions regarding pricing of the products.

In this Industry, all the major production processes have environmental impact at all stages of the process, including generation of waste, emission of harmful gases, noise pollution, water contamination etc.

The management of the company is worried about the above environmental impact and has taken initiative to preserve the environment like - research and development activities aimed at reducing pollution level, planting trees, treatment of harmful gases and airborne emissions, wastewater treatment etc.

The management of the company desires to adopt Environmental Management Accounting as a part of strategic decision-making process. Pricing of products should also factor in environmental cost generated by each product.

General overheads blanket rate per unit of leather products (be it Q or R) manufactured are ₹115 which includes–

Treatment cost of harmful gases.....₹40

Wastewater treatment cost.....₹50

Cost of planting of trees.....₹10

Miscellaneous.....₹15

Process wise information related to generation of wastewater and harmful gases is given as below–

	Tanning	Dyeing	Finishing	Total
Wastewater generated (litres per week)	900	600	0	1,500
Emission of harmful gases (cc per week)	400	300	100	800
Cost allocation to Product Q	70%	50%	70%	
Cost allocation to Product R	30%	50%	30%	

The remaining overheads cost (miscellaneous) and cost of planting trees can be allocated equally between Product Q and Product R.

Required

(i) CALCULATE the product wise profitability based on the original cost allocation.

(ii) RECALCULATE the product wise profitability based on activity-based costing (Environment driven costs).

(iii) ANALYZE the difference in product profitability as per both the methods.

(i) Product Wise Profitability as per Original Allocation Methodology

(Figures in ₹ per unit of leather produced)

Particulars	Product Q	Product R	Total
Selling Price	620	420	1,040
Direct Material (Refer Table 1)	286	174	460
Direct Labour (Refer Table 1)	186	114	300
Overheads	115	115	230
Total Expenses	587	403	990
Profit	33	17	50
Profitability (%)	**5.32%**	**4.05%**	×

Workings

Table 1 Cost Allocation to the Products

(Figures in ₹ per unit of leather produced)

Particulars	Tanning			Dyeing			Finishing			Total		
	Q	R	Total	Q	R	Total	Q	R	Total	Q	R	Grand Total
Direct Material	98	42	140	90	90	180	98	42	140	286	174	460
Direct Labour	63	27	90	60	60	120	63	27	90	186	114	300

(ii) Product wise profitability based on activity-based costing using *environment driven costs* requires the following steps:

- For convenience let presume only 2 units (1Q and 1R) are manufactured, currently the total overhead of ₹230 (115×2) is equally divided between Q and R i.e. ₹115 per unit of Q and R. But this is blanket or convention approach of allocation and misleading too. Hence the total overhead of ₹230 need to be divided such as ABC as required in question
- Breakdown of total overhead cost of ₹230 per unit into treatment cost of harmful gases, wastewater treatment cost, cost of planting trees and other overhead costs. Refer Table 2 for the breakup.
- Treatment cost of harmful gases, wastewater treatment cost need to be individually allocated to various processes based on relevant cost drivers. Refer Table 3 for cost allocation to process.
- The overheads mentioned in point above thus allocated to the various processes, will be reallocated to products based on the specific ratios given in the problem. Refer Table 4 for cost allocation to products.

Product Wise Profitability Statement based on ABC using *environment driven costs*

(Figures in ₹ per unit of leather produced)

Particulars	Product Q	Product R	Total
Selling Price	620	420	1,040
Direct Material (Refer Table 1)	286	174	460
Direct Labour (Refer Table 1)	186	114	300
Allocation of Overheads			
Treatment Cost of Harmful Gases (Refer Table 4)	50	30	80
Wastewater Treatment Cost (Refer Table 4)	62	38	100
Cost of Planting Trees (shared equally)	10	10	20
Other Overhead Cost (shared equally)	15	15	30
Total Expenses	609	381	990
Profit	11	39	50
Profitability %	**1.77%**	**9.29%**	×

Workings

Table 2: Breakdown of General Overheads (at total level of ₹ 230)

Overhead	Amount (₹)	Allocation basis between products
Treatment Cost of Harmful Gases	80	Emission of Harmful Gases (cc per week)
Wastewater Treatment Cost	100	Wastewater Generated (litres per week)
Cost of Planting Trees	20	Equally *between* Products Q and R
Miscellaneous	30	Equally *between* Products Q and R
Total General Overheads	230	

Table 3: Allocation of Treatment Cost *to various process*

Process Wise Information (Basis of apportionment, Cost Driver and their volume)

Overhead	Amount (₹)	Allocation Basis Between Products	Tanning	Dyeing	Finishing	Total
Treatment Cost of Harmful Gases	80	Emission of Harmful Gases (cc per week)	400cc	300cc	100cc	800cc
Wastewater Treatment Cost	100	Wastewater Generated (ltr. per week)	900lt.	600lt.	---	1,500lt.

Cost Allocation to Process

Overhead	Amount (₹)	Allocation Basis Between Products	Tanning (₹)	Dyeing (₹)	Finishing (₹)	Total (₹)
Treatment Cost of Harmful Gases	80	Emission of Harmful Gases (cc per week)	40	30	10	80
Wastewater Treatment Cost	100	Wastewater Generated (litres per week)	60	40	0	100

Table 4: Reapportionment of Treatment Cost to Product Q and R (₹)

Overhead	Tanning	Dyeing	Finishing	Total
Treatment Cost of Harmful Gases	₹40	₹30	₹10	₹80
Cost Allocation % to Product Q	70%	50%	70%	×
Cost Allocation % to Product R	30%	50%	30%	×
Cost Allocation to Product Q	₹28	₹15	₹7	₹50
Cost Allocation to Product R	₹12	₹15	₹3	₹30
Wastewater Treatment Cost	₹60	₹40	---	₹100
Cost Allocation % to Product Q	70%	50%	70%	×
Cost Allocation % to Product R	30%	50%	30%	×
Cost Allocation to Product Q	₹42	₹20	---	₹62
Cost Allocation to Product R	₹18	₹20	---	₹38

(iii) Analysis of the difference in product profitability as per both the methods

In the first method, general overhead costs are allocated to the products Q and R, irrespective of the environment costs that each product incurs. General overhead costs are to each product equally. The resultant product profitability shows that Product Q yields 5.32% and Product R yields 4.05% profitability. Therefore, the "QR" Ltd. would conclude that Product Q is more profitable.

In the next method, general overhead costs are bifurcated to identify "hidden" environment costs that are incurred on account of manufacturing these products. Environment costs are first traced to the process that generates harmful gases and wastewater, for which treatment is done. It can be seen that Tanning process, followed by Dyeing and Finishing process generates the maximum amount of waste. Therefore, by proportioning the cost based on the waste generated, more cost is allocated to Tanning the process. Similarly, Dyeing and Finishing are allocated lesser cost since they do not generate as much waste. It is further given that 70% of the cost of Tanning relates to Product Q. This is much higher than the 50% that was allocated to the Product as per the first method.

Accordingly, the revised workings show that Product Q yields 1.77% and Product R yields 9.29% profitability. The reason being, Product Q generates more environment driven costs as compared to Product R.

"QR" Ltd. would therefore increase the selling price of Product Q if it wants to maintain profitability as per the original method. However, the more sustainable approach would be find out ways of reducing wastewater and harmful gases the manufacturing process produces. This would in turn result in reduction of environment driven costs such as wastewater treatment and treatment of harmful gases. This would sustain profits in the long run.

Q13

7. Following three independent situations pertaining to environmental management and sustainability are provided to you:

Situation I

Wasco Limited is a chemical company which uses chloro-fluorocarbons (CFC) in the production of chemical. As awareness of the environmental damage caused by CFC spread, Wasco Limited stopped using CFC in its production processes and analysed and redesigned its product range much before the legislation controlling use of CFC introduced by the Government.

Situation II

Energy drink manufacturer Cool Limited was ordered to submit a yearly report to the Ministry of Environment and Forests on activities, which contains information concerning collection, recovery and recycling of packaging waste, fulfilment of the targets, volume of recovered and recycled packaging waste by type of material and declaration that all compulsory contributions and taxes have been paid.

Situation III

KOA Limited has achieved a 25% reduction of energy consumption through its "Go Renewable" initiative. For, the company a 25% reduction represents a cost saving of about Rs. 30,00,000/-.

Required

Read the above three situations and EXPLAIN:

(i) Why Wasco Limited stopped using CFC and redesigned its product range much before legislation introduced by Government?

(ii) The risk exposure of Cool Limited.

(iii) How focusing on environmental sustainability provides opportunity to KOA Limited for reducing costs?

(i) Ever increasing and demanding environmental regulation is forcing companies to change their practices. In many countries, numerous pieces of legislation cover areas such as air quality, climate change, hazardous substances, packaging, waste, and water quality.

The trend is very much in the direction of increased and more stringent legislation. Environment sustainability is not an issue that can be avoided by any organisation.

Organisations need to consider how environmental regulation will impact their operations and the cost of doing business.

By stopping the use of CFC much before the legislation, Wasco Limited gained advantages over its rivals. Wasco's actions were integral to its own strategic success, and instrumental in driving through the subsequent legislation from which the company later benefited. This will also help Wasco Limited to improve their brand image among the stakeholder as corporate citizen.

(ii) Organizations increasingly have to demonstrate that they are managing all of their risks systematically and responsibly. This includes environmental risks- risks that are a result of impacts of the organization on the environment. By assessing the environmental risks associated with their activities, processes, product, and services, organizations can identify their potential legal and business exposure. Non-compliances can cause enormous financial impacts, such as fines, penalties, legal costs, and damages.

Thus, Cool Ltd is exposed to environmental risks.

(iii) Focusing on environmental sustainability will often provide opportunities for reducing costs. For example, reducing carbon impacts often also saves energy costs. Similarly, programmes for reducing wastes improve environmental performance and reduce operating costs.

Reducing environmental impacts can also reduce or eliminate associated fines, levies, and other compliance costs.

Focusing on environmental sustainability thereby making investments in developing clean technologies and more energy-efficient products and processes will not only save the organization money, but could also be patented and/ or sold to other organizations, providing an additional source of income. KOA Limited may have carbon credit for efficiency in reducing energy and sell on the open market, thereby actually generating revenue.

Q14

Illustration 2

*Great Eastern Appliances Ltd. (GEAL) manufactures consumer durable products in a **very highly competitive market**. GEAL is considering launching a new product 'Kitchen Care' into the market and gathered the following data:*

Expected Market Price..... ₹ 5,000 per unit

Direct Material Cost..... ₹ 1,850 per unit

Direct Labour Cost..... ₹ 80 per hour

Variable Overhead Cost..... ₹ 1,000 per unit

Packing Machine Cost (specially to be purchased for this product)... ₹ 5,00,000

GEAL expects the selling price for the new product will continue throughout the product's life and a total of 1,000 units can be sold over the entire lifetime of the product.

Direct labour costs are expected to reduce as the volume of output increases due to the effects of 80% learning curve (index is -0.3219). The expected time to be taken for the first unit is 30 hours and the learning effect is expected to end after 250 units have been produced. Units produced after first 250 units will take the same time as the 250th unit.

Required

(i) CALCULATE the expected total labour hours over the lifetime of the product 'Kitchen Care'.

(ii) CALCULATE profitability of product 'Kitchen Care' that GEAL will earn over the lifetime of the product.

(iii) CALCULATE average target labour cost per unit over the lifetime of the product if GEAL requires average profit of ₹ 800 per unit, to achieve its long-term objectives.

(iv) Implementation of the target costing technique requires intensive marketing research. Why intensive marketing research is required to implement target costing technique? COMMENT.

Note: $250^{-0.3219} = 0.1691$, $249^{-0.3219} = 0.1693$

Solution

(i) Calculation of 'Total Labour Hours' over the Lifetime of the Product 'Kitchen Care'

The average time per unit for 250 units is

$$Y_x = ax^b$$
$$Y_{250} = 30 \times 250^{-0.3219}$$
$$Y_{250} = 30 \times 0.1691$$
$$Y_{250} = 5.073 \text{ hours}$$

Total time for 250 units = 5.073 hours × 250 units = 1,268.25 hours

The average time per unit for 249 units is

$$Y_{249} = 30 \times 249^{-0.3219}$$
$$Y_{249} = 30 \times 0.1693$$
$$Y_{249} = 5.079 \text{ hours}$$

Total time for 249 units = 5.079 hours × 249 units = 1,264.67 hours

Time for 250th unit = 1,268.25 hours – 1,264.67 hours = 3.58 hours

Total Time for 1,000 units = (750 units × 3.58 hours) + 1,268.25 hours

= 3,953.25 hours

(ii) Profitability of the Product 'Kitchen Care'

Particulars	Amount (₹)	Amount (₹)
Sales (1,000 units)		50,00,000
Less: Direct Material	18,50,000	
Direct Labour (3,953.25 hours × ₹80)	3,16,260	
Variable Overheads (1,000 units × ₹1,000)	10,00,000	31,66,260
Contribution		18,33,740
Less: Packing Machine Cost		5,00,000
Profit		13,33,740

(iii) Average 'Target Labour Cost' *per unit*

Particulars	Amount (₹)
Expected Sales Value	50,00,000
Less: Desired Profit (1,000 units × ₹800)	8,00,000
Target Cost	42,00,000
Less: Direct Material (1,000 units × ₹1,850)	18,50,000
Variable Cost (1,000 units × ₹1,000)	10,00,000
Packing Machine Cost	5,00,000
Target Labour Cost	8,50,000
Average Target Labour Cost *per unit* (₹8,50,000 ÷ 1,000 units)	850

(iv) Target cost is the difference between estimated selling price of a proposed product with specified functionality and quality and the target margin. This is a cost management technique that aims to produce and sell products that will ensure the target margin. It is an integral part of the product design. While designing the product, the company needs to understand what value target customers will assign to different attributes and different aspects of quality. This requires use of techniques like *value engineering* and *value analysis*. Intensive marketing research is required to **understand customer preferences** and **the value they assign** to each attribute and quality parameter. This insight is required to be developed must before the product is introduced. The company plays within the space between the maximum attributes and quality that the company can offer and the minimum acceptable to target customers. Therefore in absence of intensive marketing research, the target costing technique cannot be used effectively.