

Value Chain Analysis

2. X is a leading toy manufacturing firm. Having commenced its commercial operations in the year 1990, the firm has a state-of-the-art manufacturing facility in India. It sells toys through retail outlets and the firm's website. X has been pioneering the concepts of quality and safety in toys and has been instrumental in raising the quality standards of toys in the Indian Market.

X's mission is to influence parents to spend on toys that enable every child to grow with quality toys that contributes to his/ her wholesome development.

X procures the materials from a number of different suppliers. All of the purchased material are dispatched to its warehouse located at its factory and are held there unless they are moved to production. After production is completed, finished toys are moved to X's retail outlets by its own vehicles. Each week, the vehicles follow the same time schedule regardless of the weight they are carrying. Finished toys that are sold through the X's website are dispatched to its distribution centre.

X has recently got the contract to manufacture a new toy that is 'Ty-Z', a mini cartoon based on a character from a famous international animated film. X has not been given any target price, hence is free to set the selling price of 'Ty-Z', however, must pay a royalty of 10% of the selling price to the film director. X is also planning to sell 'Ty-Z' through its retail outlets.

X has decided to follow a target costing technique for 'Ty-Z'. Marketing manager has determined the selling price to be around ₹1,750 per 'Ty-Z'. X needs a margin of 26% of the selling price of 'Ty-Z'.

For the estimated costs per 'Ty-Z' refer Annexure.

Required

DISCUSS three primary activities of value chain through which X can minimise gap if any.

Annexure
Estimated Costs per 'Ty-Z'

	₹
Material C	150.50
Material D	122.50
Other Material	see note below
Labour (0.4 hours at ₹1,050 per hour)	420.00
'Ty-Z'- specific production overhead cost	132.30
'Ty-Z'- specific selling and distribution cost	166.60
Note- Each 'Ty-Z' requires 0.70 kg of 'other materials'. These 'other materials' are procured from a supplier at a cost of ₹280 per kg and around 5% of all purchased materials are found to be downgraded.	

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

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

2. In case of X, there is a **cost gap of ₹78.22**. Where a gap exists between the *current estimated cost levels* and the *target cost*, it is essential that this gap be closed. Cost gap can be removed by **reducing 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.

In Xs Value Chain, three primary activities are:-

Inbound logistics

These are activities concerned with receiving, storing and distributing the inputs (raw material) to the production process. The *relationship with supplier* is a key component in this process. Currently, X procures materials from multiple suppliers and stores these materials in its store. **Shifting to a just-in-time (JIT) system technique** in procurement of materials could possibly save substantial storage costs provided the JIT supplier must agree to take the responsibility for the good quality of materials supplied. This will also become a source of savings because downgraded items will be removed. However, X might have to pay additional payout to a supplier for JIT purchasing to work.

Outbound logistics

These activities involve collecting, storing and distributing the products to the customers. At X, scheduled transportation of toys to retail outlets is outbound logistics activity. Potentially, the scheduled transportation of toys to retail outlets every week is not an efficient way. Such deliveries do not consider whether toy is required at retail outlets or not, hence X may possibly deliver toys to retail outlets those do not need toys and suffer unnecessary transportation costs.

X should plan to **implement EDI system** that will help it to improve warehousing and logistics by automatically tracking inbound shipments as well as outbound products. Adopting EDI, X can not only improve processes but also streamline inventory management across many channels. However, it will require setup time and a learning curve to implement the same.

Marketing and sales

Marketing and sales provide the means by which the customers are made aware of the product. At X, the sales of toys via its retail outlets and website are marketing and sales activities.

X is planning to sell 'Ty-Z' via retailers. If X sales 'Ty-Z' through its website rather than through retail outlet, significant cost could easily be avoided. Simultaneously, X will be able to expose itself to **attract international customers** to buy 'Ty-Z' as product is based on character from a famous international animated film.

Overall, X may create a *cost advantage* by **reconfiguring** the Value Chain. Reconfiguration means structural changes such a new production process, new distribution channels or a different sales approach as discussed above.

Workings

Statement Showing Computation of Cost GAP

	₹
Sales Price	1,750.00
Less: Royalty @10%	175.00
Less: Profit @26%	455.00
Target Cost 'Ty-Z'	1,120.00
Material C	150.50
Material D	122.50
Labour (0.40 hours at ₹1,050 per hour)	420.00
Other Material (0.70 kg × ₹280 per kg) / 0.95	206.32
Production Overheads Cost	132.30
Distribution and Sales Cost	166.60
Estimated Cost 'Ty-Z'	1,198.22
Cost Gap	78.22



CS → 1-4, 22

- Customer Account Profitability – Profitability associated with each customer. What companies fail to do is measure profit at the most meaningful and controllable level, the customer level. Understanding the underlying components of cost and addressing specific causes of poor profitability will significantly improve bottom-line performance.
 - Customer Life Time Value - It is the net present value of the projected future cash flows from a lifetime of customer relationship.
- (c) Benefits of Supply Chain Management - Tangible benefits such as inventory reduction, personnel reduction, productivity improvement; order management improvement, financial cycle improvement etc. Further it results in information visibility, new/ improved processes, customer responsiveness, standardization-flexibility & globalization of business performance.
- Gain Sharing Arrangements – Gain sharing is an approach to the review and adjustment of an existing contract, or series of contracts, where the adjustment provides benefits to both parties.
 - Outsourcing – Outsourcing (also sometimes referred to as "contracting out") is a business practice used by companies to reduce costs or improve efficiency by shifting tasks, operations, jobs or processes to another party for a span of time.



TEST YOUR KNOWLEDGE

Cost of Quality/ Total Quality Management

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

Required

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

2. The CEO of P Limited is concerned with the amounts of resources currently spent on customers' warranty claims. Each box of its product is printed with the logo: "satisfaction guaranteed or your money back". P Limited is having difficulty competing with X Limited because it does not have the reputation for high quality that X Limited enjoys. Since the warranty claims are so high, the CEO of P Limited would like to evaluate what costs are being incurred to ensure the quality of the product. Following information is collected from various departments within the company relating to 2019-20:

Particulars of Costs	(₹)
Warranty claims	4,25,000
Employee training costs	1,20,000
Rework	3,00,000
Lost profits from lost customers due to impaired reputation	8,10,000
Cost of rejected units	50,000
Sales return processing	1,75,000
Testing	1,70,000

For the year 2020-21, the CEO is considering spending the following amounts on a new quality programme:

	(₹)
Inspect raw material	1,20,000
Reengineer the production process to improve product quality	7,50,000
Supplier screening and certification	30,000
Preventive maintenance on plant equipment	70,000

P Limited expects the new quality programme to save costs by the following amounts:

	(₹)
Reduction in lost profits from lost sales due to impaired reputation	8,00,000
Reduction in rework costs	2,50,000
Reduction in warranty costs	3,25,000
Reduction in sales return processing	1,50,000

Required

- (i) PREPARE a 'Cost of Quality Statement' for the year 2019-20 showing the percentage of the total costs of quality incurred in each cost category.
 - (ii) PREPARE a 'Cost Benefit Analysis' of the new quality programme showing how the quality initiative will affect each cost category.
 - (iii) STATE how the manager trade-offs among the four categories of quality costs.
3. A company produces and sells a single product. The cost data per unit for the year 2020 is predicted as below:

	₹ per unit
Direct Material	35

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

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

2. (i) Cost of Quality Statement

For the year 2019-20

Particulars of Costs	Cost Incurred (₹)	Total Cost Incurred (₹)	% of Total Costs of Quality
Preventive Costs:			
Employee training	1,20,000	1,20,000	5.85%
Appraisal Costs:			
Testing	1,70,000	1,70,000	8.29%
Internal Failure Costs:			
Rework	3,00,000	3,50,000	17.08%
Cost of rejected units	50,000		
External Failure Costs:			
Lost profits from lost sales due to impaired reputation	8,10,000	14,10,000	68.78%
Sales return processing	1,75,000		
Warranty costs	4,25,000		
Total Cost of Quality	20,50,000		100%

(ii) Cost Benefit Analysis of New Quality Programme

Particulars of Costs	Additional (Costs) / Cost Savings (₹)	Total New (Costs) / Cost Saving (₹)
Preventive Costs:		
Reengineer the production process	(7,50,000)	(8,50,000)
Supplier screening and certification	(30,000)	
Preventive maintenance on equipment	(70,000)	

Appraisal Costs:		
Inspect Raw Materials	(1,20,000)	(1,20,000)
Internal Failure Costs:		
Reduction in rework costs	2,50,000	2,50,000
External Failure Costs:		
Reduction of lost profits from lost sales	8,00,000	12,75,000
Reduction from sales return	1,50,000	
Reduction from warranty costs	3,25,000	
Total Savings/ (Costs) from Quality Programme		5,55,000

- (iii) Investment in prevention costs and appraisal costs (also known as costs of good quality), reduces internal and external failure costs (also known as cost of poor quality).

Costs incurred before actual production begins, to prevent defects and other product quality issues, are known as preventive costs. In the given example, reengineering production process, screening / certification of suppliers and preventive maintenance of equipment are preventive costs. Likewise, appraisal costs are incurred to ensure that activities conform to desired quality requirements. They are incurred in all stages of production. In the given example inspection of raw material is an appraisal cost.

While preventive and appraisal costs would not directly improve the quality of the product, they would definitely reduce internal failure costs like rework costs or external failure costs like sales returns or warranty claims. These would also enhance the reputation of the product for its standard of quality. Conversely, it follows that internal failure costs may be preferable to external failure costs since it affects the company's brand image.

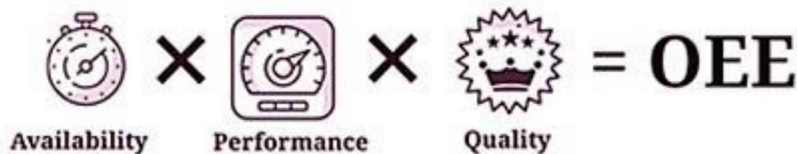
Costs incurred to ensure conformance to quality will ensure higher chances of detection of defects in the product. At the same time ensuring zero defective rate may require huge resources and therefore may be costly. Instead, companies may have the ability to absorb costs incurred due to rework, warranty claims or lost sales. Therefore, they must determine a reasonable threshold defective rate that is acceptable, a normal cost in business operations. Tools for quality production management like Total Quality Management (TQM) will help in determining the optimum cost of quality that the company is willing to bear. TQM focus on continuous improvement of an organization's business activities. This creates an awareness of quality that the company comes to expect from various processes. Things need to be done right the first time, consequently eliminating defects and waste from operations. At the same time, an in-depth knowledge of business processes provides information that can help the management set acceptable threshold limits for reasonable level of defects it is willing to bear.

Performance Measurement in TPM¹

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

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

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



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

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

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

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

Illustration 2

KIWI Ltd. manufactures spare parts and can be called "high volume based" manufacturing environment. The company is using the system of TPM for maintaining and improving the integrity of manufacturing process. There are several different automated manufacturing machines located in the plant, through which manufacturing of spare parts are done and supplied to cater the demand in the market.

A 12- hour shift is scheduled to produce a spare part in KIWI Ltd. as shown in the schedule below. The shift has three 15- minute breaks and a 10- minute clean up period.

Production Schedule for Automated machine NZ 10:

Cycle: 10 (seconds),

Spare parts Manufactured: 3,360,

SCRAP: 75,

Unplanned Downtime: 36 minutes

Required

CALCULATE OEE (Overall Equipment Effectiveness) and comment on it.

Solution**Calculation of Planned Production Time**

	Mins.
Total time (12 hrs. × 60 mins.)	720
Less: Planned downtime	
break (3 × 15 mins.)	45
clean up time	10
Planned Production Time	665

$$\text{Availability Ratio per shift} = \left\{ \frac{665 \text{ mins.} - 36 \text{ mins.}}{665 \text{ mins.}} \right\} \times 100$$

$$= 94.59 \%$$

$$\text{Actual Production} = 3,360 \text{ parts}$$

$$\text{Standard time} = 10 \text{ seconds}$$

$$\text{Standard Time Required} = 3,360 \text{ parts} \times 10 \text{ seconds} / 60$$

$$= 560 \text{ minutes}$$

$$\text{Actual Time Taken} = 665 \text{ mins.} - 36 \text{ mins.}$$

$$= 629 \text{ minutes}$$

$$\text{Performance Ratio} = \left\{ \frac{560 \text{ mins.}}{629 \text{ mins.}} \right\} \times 100$$

$$= 89.03\%$$

$$\text{Quality Ratio} = \left\{ \frac{3,360 \text{ parts} - 75 \text{ parts}}{3,360 \text{ parts}} \right\} \times 100$$

$$= 97.77\%$$

$$\text{Thus, OEE} = 0.9459 \times 0.8903 \times 0.9777$$

$$= 82.34\%$$

Comment

Since the OEE of KIWI Ltd is very close to 85% i.e. world class performance level, company should take measures to improve it and strive to attain 85% level. Availability Ratio of machine NZ 10 is 94.59% exceeding the ideal value of > 90% which is good but the Performance and Quality Ratios need attention as they are below their ideal values of > 95% and > 99% respectively.



OEE is based on three OEE factors Availability, Performance and Quality. The calculations are as follows for each of the three main factors:

$$\text{Availability Ratio} = \left\{ \frac{\text{Operating Time}}{\text{Planned Production Time}} \right\} \times 100$$

The availability is related with the total stoppage time resulting from unscheduled downtime, process setup and changeovers, and other unplanned stoppages. It is the ratio of *operating time* to the *planned production time*, and takes into consideration the theoretical production time against which unplanned downtime is highlighted.

Planned down time such as preventive maintenance, lunch break, tea breaks etc. is not regarded as a loss in this respect.

$$\text{Performance Ratio} = \left\{ \frac{\text{Ideal Cycle Time} \times \text{Total Count}}{\text{Operating Time}} \right\} \times 100$$

'Ideal Cycle Time' is the theoretical fastest possible time to manufacture one piece.

$$\text{Quality Ratio} = \left\{ \frac{\text{Good Count}}{\text{Total Count}} \right\} \times 100$$

This is third element of OEE. It is defined as the *total good production* to the *actual total production*, sometimes called 'yield'.

Connection Between TQM and TPM

The connection between TQM and TPM are summarized below:

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

defects in a process, a company can develop ways to eliminate them and practically achieve “zero defects”. The standard measure of Six Sigma is 34 errors per million.

- Process Innovation - Process innovation means the implementation of a new or significantly improved production or delivery method (including significant changes in techniques, equipment and/ or software).
- Business Process Reengineering - Business Process Reengineering (BPR) is “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed.”
 - a) Key components of BPR - Fundamental rethinking of business processes, Radical redesign if we had to start the business afresh, Achieving dramatic improvements in performance measurements, Reengineering focuses on end-to-end business processes rather than on the individual activities that comprise the processes.
 - b) Principles of BPR - Organize around outcomes, not tasks, are those who need the results of a process perform the process, Integrate the processing of information into the work process that produces the information, treat geographically dispersed resources as though they were centralized, Line parallel activities instead of integrating their results, Put the decision point where the work is performed, and build controls into the process, Capture information once and at the source.

TEST YOUR KNOWLEDGE

Just in Time

1. Pearson Metal and Motor Works (PM²W) deals in manufacturing of the copper wired electronic motor, which is specifically designed. PM²W is thinking to shift from traditional system to JIT system as part of process innovation.

CEO among the other top bosses at PM²W are hopeful that implementation of JIT will not only improve value in value chain for end consumer, but also improve overall manufacturing cycle efficiency. JIT pre-implementation team was formed to evaluate the probabilities, which collects following actual and estimated data about process;

Activity Category	Traditional System (Actual)	JIT System (Estimated)
Inspection	40	30
Storage	80	20
Moving	20	10
Processing	60	40

All data in minutes

Further, PM²W decided to practice single piece flow under JIT. PM²W received an order which is due to manufacture and delivered for 10 such motors. Total available production time to produce what customer demands is 480 minutes out of which it normal practice that 30 minutes will be spent in shutdown and cleaning. CEO is also considering JIT purchase apart from JIT production.

Required

- (i) EXPLAIN just in time.
 - (ii) CALCULATE the 'takt time' and INTERPRET the results.
 - (iii) ADVISE whether company should shift to JIT.
2. A manufacturer is considering implementing Just in time inventory system for some of its raw material purchases. As per the current inventory policy, raw materials required for 1 month's production and finished goods equivalent to the level of 1 week's production are kept in stock. This is done to ensure that the company can cater to sudden spurt in consumers' demand. However, the carrying cost of inventory has been increasing recently. Hence, the consideration to move to a more robust just in time purchasing system that can reduce the inventory carrying cost. Details relevant to raw material inventory are given below:
- Average inventory of raw material held by the company throughout the year is ₹1 crore. Procurement of raw material for the year is ₹12 crore. By moving to just in time procurement system, the company aims at eliminating holding this stock completely in its warehouse. Instead, suppliers of these materials are ready to provide the goods as per its production requirements on an immediate basis. Suppliers will now be responsible for quality check of raw material such that the raw material can be used in the assembly line as soon as it is delivered at the company's factory shop floor.
 - Increased quality check service done by the suppliers as well as to compensate them for the risk of holding the inventory to provide just in time service, the company is willing to pay a higher price to procure raw material. Therefore, procurement cost will increase by 30%, total procurement cost will be ₹15.6 crore per year. Consequently, quality check and material handling cost for the company would reduce by ₹1 crore per year. Similarly, insurance cost on raw material inventory of ₹20 lakh per year need not be incurred any longer.
 - Raw material is stored in a warehouse that costs the company rent of ₹3 crore per annum. On changing to Just in time procurement, this warehouse space would no longer be required.
 - Production is 1,50,000 per year. The company plans to maintain its finished goods inventory equivalent to 1 week's production. Despite this, in order to have a complete cost benefit analysis, the management is also factoring the possibility of production stoppages due to unavailability of raw material from the suppliers. This could happen due to of delay in delivery or non-conformance of goods to the standard required. Labor works in one 8-hour shift per day and will remain idle if there is no material to work on. Due to stoppage of production for the above reason, it is possible to have stockout of

3,000 units in a year. Stockout represents lost sales opportunity due to unavailability of finished goods, the customer walks away without purchasing any product from the company. Therefore, in order to reduce this opportunity cost and to make up for the lost production hours, labor can work overtime that would cost the company ₹10 lakh per annum. This is the maximum capacity in terms of hours that the labor can work. With this overtime, stockout can reduce to 2,000 units.

- Currently, sale price of product is ₹5,000 per unit, variable production cost is ₹2,000 per unit while variable selling, general and administration (SG&A) cost is ₹750 per unit. Raw material procurement cost is currently ₹800 per unit, that will increase by 30% to ₹1,040 per unit under Just in time inventory system.
- On an average, the long-term return on investment for the company is 15% per annum.

Required

- (i) CALCULATE the benefit or loss if the company decides to move from current system to Just in Time procurement system.
 - (ii) RECOMMEND factors that the management needs to consider before implementing the just in time procurement system.
3. Pixel Limited is a toy manufacturing company. It sells toys through its own retail outlets. It purchases materials needed to manufacture toys from a number of different suppliers. Recently, due to the entry of few reputed foreign brands in the toy market and particularly in the segment in which Pixel Ltd. is doing business, it is facing a threat to operate profitably.

Each toy requires 4 kg. of materials at ₹19 per kg. and 5% of all materials supplied by the suppliers are found to be substandard. Labour hour requirement for each toy is 0.4 hour at ₹120 per hour.

Market research has determined that the selling price will be ₹240 per toy. The company requires a profit margin of 15% of the selling price. Expected demand for toy in the coming year will be 50,000 toys. Sales and variable overhead per unit for the four quarters of the year will be as follows:

	Q1	Q2	Q3 (Festive season)	Q4 (Festive season)
Sales (units)	7,500	9,000	15,500	18,000
Variable overhead per unit (₹)	22	22	24	25

Total fixed overheads are expected to be ₹6,25,000 for each quarter.

The production manager has decided to produce 12,500 units in each quarter. Inventory holding costs will be ₹18 per unit of average inventory per quarter. Inventory holding costs are not included in above.

Normal production capacity per quarter is 15,000 toys. The company can produce further up to 6,000 units per quarter by resorting to overtime working. Overtime wages will be at 150% of normal wage rate.

Assume zero opening inventory.

Required

- (i) CALCULATE the cost gap that exists between the total cost per toy as per the production plan and the target cost per toy.
- (ii) DISCUSS how just-in-time purchasing and just-in-time production will remove the cost gap calculated in (i) above. Show calculations in support of your answer.
- (iii) EXPLAIN, how implementation of JIT production method can be a major source of competitive advantage and success of the company.

Total Productive Maintenance (TPM)

4. Pacific Coast Company Ltd. manufactures spare parts. It works in two shifts of 9 hours for 6 days in a week. Lunch break is 30 mins and other miscellaneous breaks add up to 15 minutes. The following details are collected for the last 4 weeks by the TPM team for one of their important equipment

Hours for Planned Preventive Maintenance = 15 minutes per shift

For Breakdown Maintenance = 6 hours total

Set up Changes = 14 hours total

Power Failure = 4 hours total

Standard Cycle Time per piece = 3 minutes

No of Parts Produced per shift = 140

Parts Accepted per shift = 131

Required

CALCULATE 'OEE'.

5. GVK Pharmaceuticals Ltd. is producing medication products (pills, balms etc.) and can be called high volume based production environment. There are several different automated production machines located in the plant, through which production of medicines is accomplished and fulfilled the demands. Plant operates in double shift a day each consisting of 8 hours with 25 minutes' lunch break and tea break of 10 minutes. Following data pertains to automated machine 'X-78'.

X-78

14 February 2020, Friday

Breakdown, repair and start up time (unplanned)	90 minutes
Standard cycle time	2.5 minutes <i>per tablet</i>
Quality loss due to scrap, rework, and rejection	40 tablets
Total quantity produced	280 tablets

Required

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

**ANSWERS/ SOLUTIONS**

1. (i) **Just-in-time (JIT)** is a collection of ideas that streamline a company's production process activities to such an extent that wastage of all kind viz., of time, material and labour systematically driven out of the process with single piece flow after considering takt time.

In JIT, production facility is required to be integrated with vendor system for signal (Kanban) based automatic supply which depends upon demand based consumption. Under JIT system of inventory storage cost is at lowest level due to direct issue of material to production department as and when required and resultantly less/no material lying over in store or production floor.

Prerequisite of JIT system is integration with vendor, if vendor is not integrated properly or less reliable, then situation of stock out can arise and which can result into loss of contribution.

Multitasking by employee is another key feature of JIT, group of employees should be made based upon product instead based upon function. Hence, functional allocations of cost become less appropriate.

Overall, JIT enhance the quality into the product by eliminating the waste and continuous improvement of productivity.

- (ii) **Takt Time** is the maximum available time to meet the demands of the customer; this will help to decide the speed of/ at manufacturing facility.

Takt time is the average time between the start of production of one unit and the start of production of the next unit, when these production starts are set to match the rate of customer demand.

$$\text{Takt Time} = \frac{\text{Available Production Time}}{\text{Total Quality Required}}$$

Here,

Available Production Time is 'total available time for production' – 'planned downtime i.e. spent in shutdown and cleaning' i.e. 450 minutes = 480 minutes – 30 minutes.

Total Quantity Required is 10 units

$$\text{Takt Time} = \frac{450 \text{ minutes}}{10 \text{ units}} = 45 \text{ Minutes}$$

Note - Heijunka can be applied in order to reduce variation between 'Takt times' over the production.

Interpretation

Customer's demand is 10 units, to calculate the takt time, divide the available production time (in minutes) by the total quantity required. The takt time would be 45 minutes. This means that process must be set up to produce one unit for every 45 minutes throughout the time available. As order volume increases or decreases, takt time may be adjusted so that production and demand are synchronized.

(iii) Advise on Shifting to JIT

To evaluate how much of the old cycle time was spent in inventory, we need to know how organizations assess the efficiency of their **manufacturing processes**. One commonly used measure is process cycle efficiency and to calculate the same every process is breakdown into combination of activities such as value added activities, non-value added activities and non-value added activities but strategic activities. In order to generate highest value to customer, only *value added activities* are included in process. But those non-value added activities, which are strategic in nature, also need to be part of process. Therefore, it may be possible that entire process is not efficient.

To measure efficiency of process, managers keep track of the relation between 'times taken by value added activities' in comparison 'total cycle time'. Such relation/ratio is processing cycle efficiency.

$$\text{Process Cycle Efficiency} = \frac{\text{Value Added Time}}{\text{Cycle Time}}$$

Processing time is considered as value added time; whereas time spend on inspection, storage and moving is non-value added time and included in cycle time. The higher the percentage, less the time (and costs) needs to be spent on non- value added activities such as moving and storing etc.

Computation of Processing Cycle Efficiency

Sr. No.	Activity Category	Traditional System (Actual)	JIT System (Estimated)
A.	Inspection	40	30
B.	Storage	80	20
C.	Moving	20	10
D.	Processing	60	40
E.	Value Added Time	60	40
F.	Cycle Time ... (A)+(B)+(C)+(D)	200	100
	Process Cycle Efficiency ... (E)/ (F)×100	30%	40%

Of the 200 minutes required for manufacturing cycle under PM²W's traditional system, only 60 minutes were spent on actual processing. The other 140 minutes were spent on non-value added activities, such as inspection, storage, and moving. The process cycle efficiency formula shows that processing time equalled to 30% of total cycle time. The cycle time is reduced substantially in the JIT system from 200 minutes to 100 minutes. In addition to this, the amount of time that used up in inventory i.e. non-value-added activities is also reduced. Therefore, process cycle efficiency has been increased from 30% to 40%. This significant improvement in efficiency over the previous system comes from the implementation of JIT system. Therefore, it is advantageous to shift to JIT system.

2. (i) Implementing Just in time procurement system will benefit the company as explained below:

Particulars	Current Purchasing Policy (₹)	JIT Procurement System (₹)
Raw material procurement cost per year	12,00,00,000	15,60,00,000
Quality check and material handling cost (<i>No longer required in JIT</i>)	1,00,00,000	---
Insurance Cost on raw material inventory (<i>No longer required in JIT</i>)	20,00,000	---
Warehouse rental for storing raw material (<i>No longer required in JIT</i>)	3,00,00,000	---
Overtime Charges under JIT to reduce Stockouts (note1)	---	10,00,000
Stockout Cost (note 2)	---	40,20,000
Total Relevant Cost	16,20,00,000	16,10,20,000

Therefore, moving to just in time procurement system results in savings of ₹9,80,000 per year for the company. **If reinvested**, long term return on investment for the company at 15% would yield a return of ₹1,47,000 per year.

In addition, by switching over to JIT system, company will also save working capital requirement of ₹1 crore on account of average inventory of raw material held at present. Company can earn further 15% on this amount i.e. ₹15,00,000 per year.

Therefore, total benefit for the company would be ₹26,27,000 per year.

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

3. (i) Cost gap between Total Cost *per toy* as per the production plan and the Target Cost *per toy*

Target Cost per toy

Sr. No.	Particulars	₹ per unit	For Annual Sales of 50,000 units
1	Selling Price <i>per toy</i>	240	1,20,00,000
2	Required Profit Margin (15% of selling price = 15% × ₹240 <i>per unit</i>)	36	18,00,000
3	Target Cost <i>per annum</i> (Step 1 - 2)		1,02,00,000
4	Target Cost <i>per toy</i> (Step 3 / 50,000 units)		204.00

Therefore, Target Cost is ₹204 *per toy*.

Total Cost as per production plan

Pixel Ltd. has an annual production requirement of 50,000 toys, which is also its annual sales. Given that opening inventory for the first quarter is nil. The production manager wants to produce 12,500 units *per quarter* irrespective of the sales demand for the quarter. This implies that during some quarters, there might be unsold inventory, for which inventory holding cost has to be borne. This type of production is called “produce to stock”.

Production Schedule and Inventory Holding Cost for the year

Sr. No.	Particulars	Q1	Q2	Q3	Q4	Total for the year
1	Opening Stock (units)	-	5,000	8,500	5,500	
2	Production (units)	12,500	12,500	12,500	12,500	50,000
3	Sales (units)	7,500	9,000	15,500	18,000	50,000
4	Closing Stock (units) (Step 1 + 2 - 3)	5,000	8,500	5,500	-	
5	Average Inventory = (Step 1 + Step 4) / 2	2,500	6,750	7,000	2,750	
6	Inventory Holding Cost (Average Inventory × ₹18 <i>per unit</i> of Average Inventory)	₹45,000	₹1,21,500	₹1,26,000	₹49,500	₹3,42,000

Total Cost of Production per toy as per production plan

Sr. No	Particulars	Q1	Q2	Q3	Q4	Total for 50,000 units
1	Direct Material Cost <i>per unit</i> (Note 1)	₹80	₹80	₹80	₹80	₹40,00,000
2	Direct Labour Cost <i>per unit</i> (Note 2)	₹48	₹48	₹48	₹48	₹24,00,000

3	Variable Overhead Cost <i>per unit</i>	₹22	₹22	₹24	₹25	₹11,62,500
4	Total Variable Cost <i>per unit</i> for the quarter (other than inventory holding cost) [Steps 1+ 2+3]	₹150	₹150	₹152	₹153	
5	Production (units) for the quarter (refer production schedule above)	12,500	12,500	12,500	12,500	50,000
6	Total Variable Cost for the quarter (other than inventory holding cost) [Step 4 × Step 5]	₹18,75,000	₹18,75,000	₹19,00,000	₹19,12,500	₹75,62,500
7	Inventory Holding Cost for the quarter (refer to the production schedule above)	₹45,000	₹1,21,500	₹1,26,000	₹49,500	₹3,42,000
8	Fixed Overheads	₹6,25,000	₹6,25,000	₹6,25,000	₹6,25,000	₹25,00,000
9	Total Cost [Step 6 + Step 7+Step 8]	₹25,45,000	₹26,21,500	₹26,51,000	₹25,87,000	₹1,04,04,500
10	Total Cost per toy as per production schedule (Step 9 / 50,000 units)					₹208.09

Note 1

Each toy requires 4kg of material, 5% of all materials is substandard. Therefore, procurement should factor this substandard quality.

Material required *per unit* = 4 kg / 95% = 4.21 kg

Material Cost *per toy* produced = 4.21 kg × ₹19 per kg = ₹80 *per unit*

Note 2

Each toy requires 0.40 hours. Rate per hour is ₹120 *per hour*.

Therefore, Cost *per toy* = 0.40 × ₹120 = ₹48 *per unit*

Cost Gap

= Total Cost *per toy* as per production schedule – Target Cost *per toy*

= ₹208.09 - ₹204.00 *per toy*

= ₹4.09 *per toy*

JIT System

- (ii) Just in Time Purchasing and Just in Time Production is aimed at eliminating inventory holding of raw material and finished goods respectively. Components are purchased only when there is a requirement in the production process. Similarly, finished goods are produced only when there is a demand for them. This type of production is called “produce to order”. Hence, there is neither any opening inventory nor any closing inventory, thereby no inventory holding cost.

In the given problem, this savings is off-set by the extra payment to be made to labor for overtime. Production capacity is 15,000 toys per quarter. This can be increased by 6,000 toys per quarter by incurring additional overtime cost.

The Production Plan under the Just in Time System

Sr. No.	Particulars	Q 1	Q 2	Q 3	Q 4	Total for the year
1	Opening Stock (units)	-	-	-	-	
2	Production (units)	7,500	9,000	15,500	18,000	50,000
3	Sales (units)	7,500	9,000	15,500	18,000	50,000
4	Closing (units)	-	-	-	-	
5	Inventory Holding Cost	-	-	-	-	
6	Production Beyond Capacity of 15,000 Toys <i>per quarter</i> (units)	-	-	500	3,000	

Total Cost of Production under JIT System

Sr. No	Particulars	Q1	Q2	Q3	Q4	Total for 50,000 units
1	Direct Material Cost <i>per unit</i> (Note 1)	₹76	₹76	₹76	₹76	38,00,000
2	Direct Labour Cost <i>per unit</i>	₹48	₹48	₹48	₹48	24,00,000
3	Variable Overhead Cost <i>per unit</i>	₹22	₹22	₹24	₹25	11,85,000
4	Total Variable Cost <i>per unit</i> (Steps 1+ 2+3)	₹146	₹146	₹148	₹149	
5	Production (units) for the quarter (Refer JIT production schedule above)	7,500	9,000	15,500	18,000	50,000
6	Total Variable Cost for the quarter (Step 4 × Step 5)	₹10,95,000	₹13,14,000	₹22,94,000	₹26,82,000	₹73,85,000
7	Production (units) for the quarter in excess of capacity (Refer JIT production schedule above)	-	-	500	3,000	3,500

8	Overtime Labour Cost for production in excess of capacity (Note 2) [Step 7 × 0.40 × 50% × ₹120 per hour]	₹0	₹0	₹12,000	₹72,000	₹84,000
9	Fixed Overheads	₹6,25,000	₹6,25,000	₹6,25,000	₹6,25,000	₹25,00,000
10	Total Cost for production under the JIT System (Step 6 + Step 8+ Step 9)	₹17,20,000	₹19,39,000	₹29,31,000	₹33,79,000	₹99,69,000
11	Total Cost <i>per toy</i> as per production schedule (Step 10 / 50,000 units)					₹199.38

Note 1

Carefully selected suppliers of delivering high quality materials in a timely manner directly at the shop floor, reducing the material receipt time and loss due to sub-standard material.

Note 2

Overtime wages are 150% of normal wage rate. Therefore, for every toy produced over the quarterly production capacity of 15,000 toys, 50% extra wage over and above the hourly rate has to be paid as overtime wages. Each toy needs 0.40 hours for production. Therefore, overtime cost for excess production = excess production units × 0.40 × 50% × ₹120 per hour.

Cost Gap

The cost of production *per toy* under the JIT system is ₹199.38 per toy as compared to the target cost of ₹204 *per toy* and **save ₹ 4.62 per toy**.

The savings *primarily* comes from eliminating the inventory holding cost of ₹3,42,000 per annum and sub- standard material cost of ₹2,00,000 per annum under the previous production system. This is slightly offset by the additional cost of ₹84,000 per annum that has to be paid towards overtime labor charges and ₹22,500 towards additional variable overheads. However, by switching to the JIT system, Pixel Ltd. could reduce its production cost below the target cost per toy.



This question can also be solved by assuming “*continued* material wastage” due to *sub-standard material* from suppliers.

(iii) JIT system aims at:

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

The main features of the JIT production system are:

- Material handling cost is reduced – materials move from one machine to another in an organized sequence. The production process is grouped into to manufacturing cells. These can be managed with *minimal labor*. This reduces material handling costs as also any pile up of inventory in the form of work-in-progress. In JIT procurement process, the raw material is received only when needed. *Due to significant reduction in inventory, inventory holding costs, normal wastage cost and spoilage can be avoided. Optimum arrangement of cells can lead to lesser floor space requirement, thereby reducing factory rental and overhead cost.*
- Multi-skilled labor: Hire and retain multi-skilled workers who are capable of performing a variety in operations including repairs and maintenance. Therefore, a worker is not confined to only one process in the production process. He can contribute towards other processes as well. This reduces the workforce requirement and labor idle time. The company can have a *more efficient workforce, with lesser number of workers*. There is potential to reduce labor cost on account of this.
- Minimizing defects rework and scrap: Each stage of the production process is tightly linked in a sequential manner. Defective output from one stage will stop the work at the next stage. Due to this, workers can identify and correct errors or defects instantaneously. JIT creates urgency for eliminating defects as quickly as possible since the downstream work also stops due to error in any workstation. *Production process efficiency improves and reduces rework or scrap.* The overall quality of production improves. There are other benefits to streamlining production process: *lesser need for inspection of final output and lesser sales returns due to defects. This would contribute to the product's brand value.*
- Reduced set-up time: Streamlined production process under JIT *reduces set-up time at the workstations*. When the production process has to change to make the product per the customers' demands, set-up time is incurred at the workstation. By streamlining operations, JIT system aims at reducing the set-up time, so that production can continue with the least possible interruption. This brings flexibility in the operations since the company can quickly change the production requirement, to make products to meet the customer's demand. Quick turnover improves productivity of the machine, thereby increasing the production capacity. Lesser time is spent on set-up which is not a value adding activity.
- Reduces lead time for receiving materials since the suppliers of raw material are capable of delivering high quality materials in a timely manner directly at the shop. Proper selection of such suppliers is imperative for the JIT system to be successful. If this can be achieved, then it is beneficial for the company since inventory holding of material is eliminated along with receiving *better quality of raw material in a timely manner.*

Eliminating inventory holding, scrap, material wastage, flexibility in operations by reducing set-up time, better response time to customer's demands, better skilled workforce, better quality of production, lower workforce requirement, lower floor space requirement all of these contribute towards lowering working capital requirements. These contribute to a company's competitive edge and success.

4. Calculation of Shifts

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

Calculation of Un-Planned Downtime

Breakdown Maintenance (in mins)	360
Set up Changes (in mins)	840
Power Failure (in mins)	240
Total	...(A) 1,440
Loss of Minutes per shift	...(A/ 48) 30

Calculation of Planned Production Time

	Mins.
Total time (9 hrs. × 60 mins.)	540
Less: Planned downtime	
Lunch break	30
Miscellaneous breaks	15
Preventive maintenance	15
Planned Production Time	480

$$\text{Availability Ratio} = \left\{ \frac{480 \text{ mins.} - 30 \text{ mins.}}{480 \text{ mins.}} \right\} \times 100$$

$$= 93.75 \%$$

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

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

$$\text{Standard Time Required} = 140 \text{ units} \times 3 \text{ minutes}$$

$$= 420 \text{ minutes}$$

$$\text{Actual Time Taken} = 480 \text{ mins.} - 30 \text{ mins.}$$

$$= 450 \text{ minutes}$$

$$\text{Performance Ratio} = \left\{ \frac{420 \text{ mins.}}{450 \text{ mins.}} \right\} \times 100$$

$$= 93.33\%$$

$$\text{Quality Ratio} = \left\{ \frac{131 \text{ parts}}{140 \text{ parts}} \right\} \times 100$$

$$= 93.57\%$$

$$\text{Thus, OEE} = 0.9375 \times 0.9333 \times 0.9357 = 81.87\%$$

5. Calculation of Planned Production Time

	Mins.
Total time	480
Less: Planned downtime	
tea break	10
lunch break	25
Planned Production Time	445

$$\text{Availability Ratio} = \left\{ \frac{445 \text{ mins.} - 45 \text{ mins.}}{445 \text{ mins.}} \right\} \times 100$$

$$= 89.89\%$$

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

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

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

$$= 350 \text{ minutes}$$

$$\text{Actual Time Taken} = 445 \text{ mins.} - 45 \text{ mins.}$$

$$= 400 \text{ minutes}$$

$$\text{Performance Ratio} = \left\{ \frac{350 \text{ mins.}}{400 \text{ mins.}} \right\} \times 100$$

$$= 87.50\%$$

$$\text{Quality Ratio} = \left\{ \frac{140 \text{ tab.} - 20 \text{ tab.}}{140 \text{ tab.}} \right\} \times 100$$

$$= 85.71\%$$

$$\text{Thus, OEE} = 0.8989 \times 0.8750 \times 0.8571$$

$$= 67.41\%$$



Test your Understanding

Can you list the factors which are capable to maximise a product's return over its lifecycle?

Hint

- Value Engineering at the design phase to commit the cost as low as possible.
- Reduce the time to get into the market.
- Maximise the life cycle of the product – especially extent the growth phase as much as possible.

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.

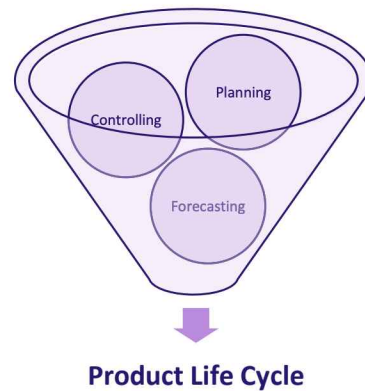


Illustration 3

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.

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 incur 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)

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.

Controlling Environmental Costs

After identification and allocation of environmental costs, the organisation needs to head towards controlling these cost starts. The **method** applied to control environmental cost **can be** oriented to **individual cause** or **individual elements** (such as water, energy) or **uniform wide across the organisation** for all the causes.

Note- *The techniques used for identification of environmental cost has implication in the selection of method or tool for controlling the environmental cost. Moreover, the **choice of approach** to control cost is highly impacted by the nature of industry, because the **type of environmental cost and their percentage to total cost will vary significantly across the sectors.***

For example, in order to reduce lifecycle costs (including full environmental cost) 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

Let's understand how environmental costs can be controlled by focusing on individual elements (through-out the organisation).

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.

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.
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)

Life Cycle Costing

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:

<i>Life Cycle Units Manufactured and Sold</i>	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

- CALCULATE the budgeted life cycle operating income for the new watch.
 - COMPUTE % of budgeted total product life-cycle costs incurred till the R & D and design stages.
 - ADVISE the strategies to be adopted by the Tt Co. Ltd. to develop a new watch.
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

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?

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.



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.

(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.

4. (i) Statement Showing Budgeted Life-Cycle Operating Income

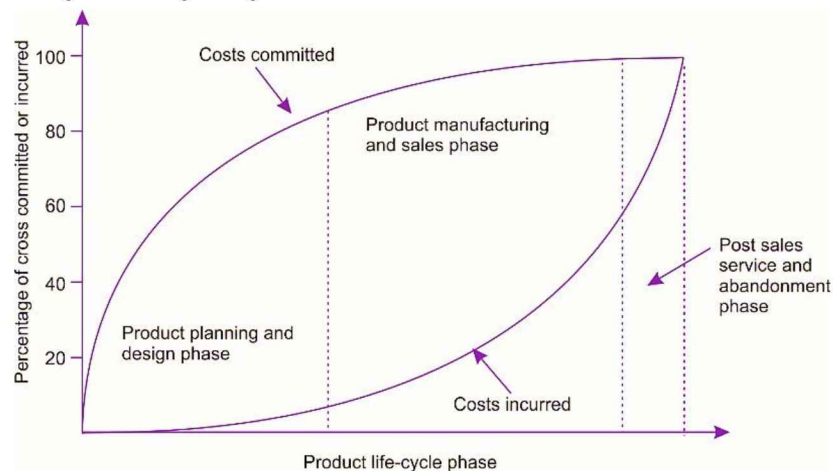
Particulars	(₹)
Revenues (₹500 × 2,40,000 units)	12,00,00,000
Less: R&D and Design Costs	80,00,000
Manufacturing Costs:	
Variable (₹120 × 2,40,000 units)	2,88,00,000

Batch $\left(2,40,000 \times \frac{\text{₹}4,000}{3,000}\right)$	32,00,000
Fixed	1,12,00,000
Marketing Costs:	
Batch $\left(2,40,000 \times \frac{\text{₹}24}{96}\right)$	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:

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

- (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.

5. (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

- (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.

8. (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%	x

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%	x

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 <i>between</i> Products Q and R
Miscellaneous	30	Equally <i>between</i> 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.



Illustration 1

A company manufactures cycles for both adults and children. Given below is information about cycles made for children–

Particulars	Traditional CVP Analysis	Activity Based CVP Analysis
Monthly Demand and Production	10,000 units	10,000 units
Selling Price	₹8,000 per unit	₹8,000 per unit
Variable Cost per unit	₹7,500 per unit	₹7,500 per unit
Fixed Cost p.m. (as identified under each cost system)	₹ 10,00,000 p.m.	₹ 8,00,000 p.m.

Fixed costs of ₹10,00,000 per month under Traditional CVP analysis are those that do not vary with respect to volume. Following an Activity Based Costing study, fixed cost that do not vary as per volume or any other cost driver has been identified to be ₹8,00,000 per month. The study revealed a milling machine is used to cut metal into steer support. Production of these steer support takes place in batches of 25 units. Once a batch for children's cycle is finished, the next batch would be that for adult cycles. Therefore, after each batch there would be a set-up change. If 10,000 children's cycles have to be produced, number of set-ups required = 10,000 steer support / 25 per batch = 400 set-ups. Each set-up costs ₹500, comprising of material costs like change of oil, jig etc. This cost was previously pooled together with fixed cost under traditional CVP analysis.

Required

- (i) FIND the break-even point per month and profit per month under the traditional CVP method and the Activity Based CVP method.
- (ii) As a plant manager, you would like to keep the number of set-ups minimum since they reduce the capacity of the machine. Suppose that at any time the milling machine can be used to produce other type of cycles like adult cycles, sports cycles etc. Therefore, you propose to increase the batch size of children's steer support to 50 units in one batch. The number of set-ups will reduce from 400 (10,000 units / 25 units) to 200 (10,000 units / 50 units). Due to larger batch production, additional inventory storage area would be required to store that will cost the company ₹50,000 per month extra. ANALYSE the impact on BEP (units per month) and profits per month.
- (iii) When should labour cost be factored into the calculation of cost of a set-up? Explain.
- (iv) How can the number of set-ups and cost of each set-up impact flexibility of the milling machine? Explain.

Solution

- (i) (a) Break-even point (units per month) and profit per month under traditional CVP analysis:

Selling Price per unit	₹8,000
Variable Cost per unit	₹7,500
Contribution per unit	₹500
Fixed Cost per month	₹10,00,000
Break-even Point (per month in units) = Fixed Cost p.m. / Contribution p.u. = ₹10,00,000 / ₹500 per unit	2,000 units
Monthly Demand (units)	10,000 units
Profit per month = {Monthly demand (units) × Contribution per unit} – Fixed Cost per month = (10,000 × ₹500 per unit) - ₹10,00,000	₹40,00,000

- (b) Break-even point (units per month) and profit per month under Activity Based CVP method. Number of units produced per batch is 25. Therefore, number of set-ups will be 10,000 units / 25 units = 400 per month.

Selling Price per unit	₹8,000
Variable Cost per unit	₹7,500
Contribution per unit	₹500
Fixed Cost per month (per Activity Based method)	₹8,00,000
Break-even Point (per month in units) = {Fixed Cost p.m. + (number of set-ups × cost per set-up)} / Contribution p.u. = {₹8,00,000 + (400 × ₹500 per set-up)} / ₹500 per unit = ₹10,00,000 / ₹500 per unit	2,000 units
Monthly Demand (units)	10,000 units
Profit per month = {Monthly demand (units) × Contribution per unit} – (Fixed Cost per month + Set-up cost per month) = (10,000 × ₹500 per unit) – (₹8,00,000 + ₹200,000) = ₹50,00,000 – ₹10,00,000	₹40,00,000

Although, the BEP units and the profit per month are the same under both methods, Activity Based method has brought forth the point that there are 400 set-ups being performed per month. This would give the management more information to work with in order to improve operations.

- (ii) Break-even point (units per month) and profit per month under Activity Based CVP analysis: Batch size increased from 25 to 50 units, monthly set-ups reduce from 400 to 200 per month.

Selling Price per unit	₹8,000
Variable Cost per unit	₹7,500
Contribution per unit	₹500
Fixed Cost per month (per Activity Based method)	₹8,50,000
Additional cost p.m. for inventory storage = ₹50,000	
Break-even Point (per month in units) = {Fixed Cost p.m. + (number of set-ups × cost per set-up)} / Contribution p.u. = {₹8,50,000 + (200 × ₹500 per set-up)} / ₹500 per unit = ₹9,50,000 / ₹500 per unit	1,900 units
Monthly Demand (units)	10,000 units
Profit per month = {Monthly demand (units) × Contribution per unit} – (Fixed Cost per month + Set-up cost per month) = (10,000 × ₹500 per unit) – (₹8,50,000 + ₹1,00,000) = ₹50,00,000 – ₹9,50,000	₹40,50,000

Analysis

It can be concluded by increasing the batch-size, the capacity of the machine can be increased. The time freed by reducing set-ups from 400 per month to 200 per month can now be used to produce parts for other cycles. Since the number of set-ups would reduce, so will the monthly set-up costs. Even after off-setting the increase in storage cost, profits have increased by ₹50,000 per month (₹40,50,000 - ₹40,00,000 per month). Consequently, break-even point has reduced from 2,000 units per month to 1,900 units per month. This reduction is due to the savings in the overall set-up costs due to lower number of set-ups.

- (iii) Inclusion of labor cost in the cost of set-up would depend on their *availability*:
- Cost of temporary labour hired for particular set-up or cost of outsourcing of set-up activities would be included in set-up costs.
 - Cost of permanent labour used for set-up, who are otherwise idle would not be included in set-up costs since the salaries paid to them has to be incurred anyway, it is a sunk cost.
 - However, where permanent labour is used for set-up, who are otherwise fully engaged in the production process and additional labour supplies are unavailable in the short term, and where no further overtime working is possible, the opportunity cost of labour needs to be considered along with the hourly labour rate.
- (iv) Set-ups reduces the production utility of a machine. Lower number of set-ups or lower set-up time can improve the utilization of the machine. This also gives the company flexibility to keep changing the batches produced at the milling machine to cater to children's cycles and adult cycles as per its requirement. The other factor that impacts flexibility of production would be the set-up costs. Lower the set-up costs, higher the flexibility to change batches produced at the milling machine to cater to each type of cycle.

2. Aayla runs the Planetarium Station in New Delhi, India. The strength of the station lies in its live interactions and programs for visitors, students and amateur astronomers. The station is always active with programs for school and college students and for amateur astronomers. One of the station's key attractions is a big screen IMAX theatre. IMAX is a 70 mm motion picture film format which shows images of far greater size and resolution than traditional film systems. The IMAX cinema projection standards were developed in Canada in the late 1960s. Unlike traditional projectors, the film is run horizontally so that the image width is greater than the width of the film.

The average IMAX show at the station attracts 120 visitors (50 children and 70 adults) at a ticket price of ₹160 for children and ₹200 for adults. Aayla estimates that the running costs per IMAX show are ₹10,000. In addition, fixed costs of ₹7,500 are allocated to each show based on annual estimate of the number of IMAX shows.

The Hobart School has approached Aayla about scheduling an extra show for its class VIII students. One hundred students and five teachers are expected to join the special show on the 'Planets & Solar System', a feature that is currently showing. The school has asked Aayla for a price quote. The special show will take place at 08:30 AM when the IMAX is not usually open.

Required

RECOMMEND the minimum amount that Aayla should charge.

3. The President of Automation Limited, a 150 persons engineering company, decided it was time to fire the company's biggest client. Although the client provided close to 60% of the company's annual revenue, Automation Limited decided that dropping this client was necessary. The client was profitable.

The President of Automation Limited stated "We cannot be a great place to work without employees, and this client was bullying my employees. Its demands for turnaround were impossible to meet even with people working seven days a week. No client is worth losing my valued employees".

The initial impact on revenues was significant. However, Automation Limited was able to cut costs and obtain new customers to fill the void. Moreover, the dropped client later gave Automation Limited two projects on more equitable terms.

Required

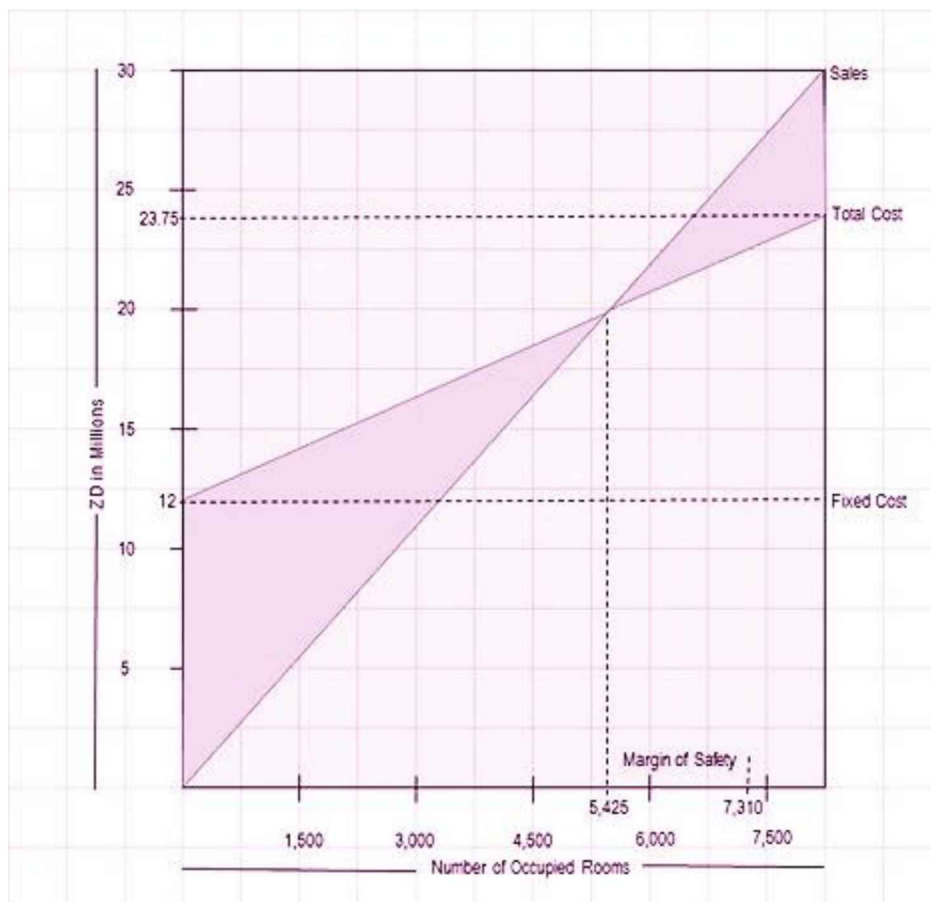
DISCUSS the reasons behind dropping of a profitable client by Automation Limited.

4. Hotel Nikko, Zeeland, an affordable leisure hotel resort is an ideal retreat to escape, unwind and enjoy peace of mind. Set amid expansive tropical greenery in the enclave of Zeeland, Hotel Nikko is designed for pleasure, where services reign supreme and Italian-style architecture of its 25 classic rooms harmonize with nature. Hotel Nikko, Zeeland is a beachfront resort that features a good choice of swim-up pool bar, gym, and variety of restaurants. A wide array of water sport activities like surfing, sailing, jet skiing etc. are available from beach operators at walking distance. The hotel is synonymous with enjoyment and value for money, with a large choice of very attractive "All Inclusive" packages.

Nikko charges guests ZD 2,700 per room per night, irrespective of single or double occupancy. The variable cost is ZD 900 per occupied room per night. The Nikko is available throughout 365 days a year and has a 75% budgeted occupancy rate. Fixed costs are budgeted at ZD 9 million and are incurred evenly during the year.

During the second quarter (Q2) of the year, usually the room occupancy rates remains substantially below the levels expected at other quarters of the year. Nikko is expecting to sell 900 occupied room nights during Q2. Management is considering strategy to improve profitability, including closing the Nikko for the duration of Q2 or adopting one possible option as follows –

There is scope to extend the Nikko by creating enough space to run a Rustic Chic, Italian Style restaurant to serve its guests. The annual revenues, costs and sales volumes for the combined operations are given in the following graph–



Note

Zeeland's home currency is the ZD.

Required

ANALYZE the profit improvement plan.

Required

(iii) EXPLAIN, by giving examples, how each of the four types of quality cost could be reduced. You should also IDENTIFY in which primary activity each one of your examples would occur in Aditya Group's value chain.

10. N2 Co. is the manufacturer and supplier of firefighting and safety equipment for industrial use and follows the international quality standards and uses the high grade raw material. It is a fast-growing brand that protects millions of people across the India, every single day. N2 has been offered a bid on a prospective export contract for 20,000 commercial fire extinguishers with following specification from USA buyer and the delivery terms is FOB.

"two-gallon cylinder holding 10 pounds of multi-purpose dry chemical at 380 PSI"

N2 is exporting first time. The price computation per fire extinguisher is as follows:

	₹	₹
Direct Material		
Circle Part Cost	620	
Necking Part	30	
Bottom Part	50	
Fire Extinguisher Powder	590	
Heat Process	50	
Nozzle	60	
Meter	20	
Pipe	50	
Nitrogen	30	1,500
Direct Labor (2 hrs. × ₹40)		80
Leakage Testing		50
Variable Overheads (including packing)		214
Export Clearance Charges on FOB term		36
Fixed Overhead		100
Total		1,980
Add: Markup @ 10%		198
Price		2,178
USD to INR		67
Price in USD		32.51

After quotation of USD 32.51, the buyer is negotiating the price and ready to pay only USD 28.50.

Required

ADVISE whether it is worth accepting at USD 28.50 considering other factors.

11. **Mount Sports Manufacturing Facilities (MSMF)** deals in manufacturing of sports articles. Although MSMF is major market player but can capture the market further. Currently MSMF manufactures five types of badminton shuttle named as P-101, P-102, P-103, P-104 and P-105. Production facilities are limiting factor at MSMF. Production and marginal cost data of these 5 products are specified in table below;

Particulars	P-101	P-102	P-103	P-104	P-105
Monthly production (in units)	1,000	1,200	2,000	3,000	1,500
Direct Material Cost (₹per unit)	6	4	7	3	6
Direct Labour Cost (₹per unit)	4	9	5	8	5
Variable Production Overhead (₹per unit)	2	3	2	2	1

On drive to cost leadership strategy, MSMF is thinking to out-source some of the products. Shuttles can be sourced from a well-established company 'Protease' at the following prices. There is no tie-in between products, all products can outsources individually. These costs are on CIF basis;

Particulars	P-101	P-102	P-103	P-104	P-105
Outsourcing Cost/Buy in Cost (₹per unit)	17	18	18	11	15

Company-wide fixed overheads are of ₹15 Lacs each year. Out of which ₹2,40,000 is directly attributable to the production of these 5 products on annual basis. This fixed overhead of ₹2,40,000 is evenly split across such 5 products and entirely avoidable. Till date company does not have experience to outsource any element of production.

Mr. Singh who is newly appointed management accountant, bring the huge experience to the organization on cost control and reduction techniques. While discussing the possibility of outsourcing with CFO, Mr. Singh explained the limitation of out-sourcing and also presents a white paper on gain sharing arrangement; which can be entered with supplier to whom outsourcing is considered.

CEO just entered into the office of CFO (where such discussion is ongoing) on verge of such discussion, but he heard about gain sharing arrangement and curious to know further about the same.

Required

CEO post presentation/ discussion seeks report from Mr. Singh to RECOMMEND, the product/(s) which should be outsourced. Report should also EXPLAIN gain sharing arrangement along with aspects that MSMF need to consider, ensuring success out of gain sharing arrangement as a part of out-sourcing contract with Protease.

3. With increasing completion, dynamic market changes, changing needs of customers, *non-financial* and *ethical considerations* have gained relevance in the decision-making process. A company may face the dilemma of meeting customers' needs while protecting employees' rights. While there are no clear-cut parameters to measure the impact of such decisions, they have a long-term impact on the company's operations that ensures profitability and sustainability of an organization.

In the given scenario, a customer who contributes close to 60% of Automation Ltd.'s profits has been making turnaround demands that are unreasonable for the company employees to meet. Automation Ltd. has to decide whether to continue doing business with the customer based on the current terms or protecting the work environment of its employees. In the current scenario, it is in Automation's long term interests to protect its employees' rights (a non-financial consideration). Keeping this approach in mind, Automation Ltd. decided to terminate business with the profitable client. While this had a significant impact on revenues in the short term, in the long run Automation Ltd. was able to get business from new clients. Also, realizing the value of service provided, the dropped client came back with projects on equitable terms. Therefore, even though it did not make financial sense in the short run, decisions based on non-financial metrics played an important role in ensuring Automation Ltd.'s long term sustainability.

4. The Present Profit of Hotel Nikko

$$\begin{aligned} \text{Total Room Days} &= 25 \text{ Rooms} \times 365 \text{ days} \times 75\% = 6,844 \\ \text{Profit} &= \text{Total Contribution} - \text{Fixed Cost} \\ &= 6,844 \text{ room days} \times (\text{ZD } 2,700 - \text{ZD } 900) - \text{ZD } 90,00,000 \\ &= \text{ZD } 33,19,200 \end{aligned}$$

If Nikko is Shut Down during Q2

$$\text{Loss of Contribution } \{900 \text{ Room Days} \times (\text{ZD } 2,700 - \text{ZD } 900)\} = \text{ZD } 16,20,000$$

Nikko should not close its hotel during Q2. The fixed costs will still be incurred and hotel closure would result in lost contribution of ZD16,20,000. This in turn would decrease annual profits by ZD16,20,000. In addition, Nikko could lose guests at other quarters of the year, particularly their regular business customers, who may perceive the Nikko as being *non-reliable*.

Proposal of Opening an Italian Restaurant

Opening a restaurant will increase the fixed costs of the Nikko from ZD 9 million p.a. to ZD 12 million p.a. Thus, annual increment of ZD 3 million.

Average Revenue per occupied room will rise from ZD 2,700 to ZD 3,636.36... (ZD 30 Million / 8,250 rooms) because increasing guest expenditure in Italian restaurant.

The total cost predicted at a level of 8,250 occupied rooms is ZD 23.75 million which means the variable costs must be ZD 11.75 million (ZD 23.75 million – ZD 12 million fixed costs). This is a variable cost per occupied room of ZD 1,424.24... which is an increase of ZD 524.24...

Consequently, the breakeven point has gone up from 5,000 to 5,425 (as shown in the diagram) occupied rooms so the Nikko is required to sell more room nights to cover costs. However, budgeted occupancy is now 7,310 occupied room nights which is 80.11% occupancy (7,310/ 9,125). This provides a margin of safety of 1,885 occupied room nights or 25.79%. At 7,310 occupied room nights, Nikko's budgeted profit would be ZD 41,70,597 {7,310 × (ZD 3,636.36 – ZD 1,424.24) – 12 million} which is more than present budgeted profit by ZD 8,51,397. So, it is better for Nikko to go for opening an Italian Restaurant.

5. 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 × 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.

10. Workings

Statement Showing Benefit from Prospective Export Contract

	₹
Direct Material	1,500
Direct Labor (2 hrs. × ₹40)	80
Leakage Testing	50
Variable Overheads (including packing)	214
Export Clearance Charges on FOB term	36
Total Relevant Cost	1,880
USD to INR	₹67
Relevant Cost	\$28.06
Price Offered by Customer	\$28.50
Benefit <i>per extinguisher</i>	\$0.44
No. of Extinguishers	20,000
Total Benefit	\$8,800

Advise

From financial perspective, it will be profitable for N2 to accept the contract because of gain of \$8,800 (₹5,89,600) along with export incentives of drawback. Besides this, following consideration should also be taken into consideration while exporting fire extinguishers:

Statutory Compliances

Before exporting to a foreign country or even agreeing to sell to a new customer in a foreign country, N2 should be aware of foreign laws that might affect the sale. Export documentation is important as it plays a significant role in regulating the flow and movement of goods in international markets. Each country has its own prescribed statutory documents to be complied by exporters and importers. Thus, N2 should consider about the documentation and inspection compliances part of new buyer. It may include third party audit, commercial invoice and packaging list requirements, certificate requirements like- no child labour certificate, inspection certificate, reach compliance certificate etc. If any compliance requirement is not met, what will be the consequences? There may be stiff penalty has to be paid owing to non-compliance or failure to accurately comply with the export obligation.

Buyer Creditworthiness

It is necessary that before shipment the exporter to carry out its own credit check on the importer to determine creditworthiness. Thus, N2 should make a proper assessment of the creditworthiness of the foreign buyer and spend sufficient time in cross checking the credit worthiness of his counterpart to avoid any kind of unforeseen situation in future. Such information can be easily availed through contracts or through ECGC. Private agencies also provide information on paid service basis. However, this risk can be covered by asking for LC payment terms or 100% advance or opting for post shipment insurance for goods being exported.

Industry Analysis

Industry analysis involves such things as assessing the competition in the industry; the interplay of supply and demand in the industry; how the industry holds up against other industries that are emerging and providing competitions; the likely future of the industry, especially in light of technological developments; how credit works in the industry; and the exact extent of the impact that external factors have on the industry.

For N2, it is worthwhile to know the current and future demand of fire extinguisher and factors influencing the growth of global fire extinguisher market. N2 can perform industry analysis through three main ways i.e. the Competitive Forces Model (also known as Porter's 5 Forces); the broad factors analysis, also known as PEST analysis; and SWOT Analysis. It may also arrange industry report from trusted sources.

Additional Terms

Ensure that the all terms are clear and suit the business purpose. For instance, delivery terms should provide date of shipment or means of determining the date. In some circumstances, a late delivery penalty may be incurred where goods are not supplied by a specific delivery date. Therefore, N2 should evaluate whether shipment date is attainable or not. If the target shipment date could not be met, what will be the charges? Further, N2 must also check whether the foreign bank charges are subject to beneficiary account. If yes, then the same must be considered in the quotation.

Overall, N2 should accept the proposed contract only after due and careful consideration of above factors.

11. Report to;
Office of CEO,
Mount Sports Manufacturing Facilities (MSMF),
Dated – 03rd Jan 2020

Report on Outsourcing of Products to Protease

- (i) **Recommendation on out-sourcing of the products** – Product P-102 and P-104 can be out-sourced. (see computations below)

Particulars	P-101	P-102	P-103	P-104	P-105
a. Monthly production (in units)	1,000	1,200	2,000	3,000	1,500
b. Direct Material Cost (₹per unit)	6	4	7	3	6
c. Direct Labour Cost (₹per unit)	4	9	5	8	5
d. Variable Production Overhead (₹per unit)	2	3	2	2	1
e. Marginal Cost (₹per unit) (b)+(c)+(d)	12	16	14	13	12
f. Monthly Total Marginal Cost/Variable Cost (e)×(a)	12,000	19,200	28,000	39,000	18,000

g. Monthly Allocable Fixed Overhead*	4,000	4,000	4,000	4,000	4,000
h. Total Monthly Cost Production-in-house (f)+(g)	16,000	23,200	32,000	43,000	22,000
i. Outsourcing Cost/ Buy in Cost (₹per unit)	17	18	18	11	15
j. Total Monthly Cost Outsourcing/Buy in (i)×(a)	17,000	21,600	36,000	33,000	22,500

Total monthly cost of in house production is ₹1,36,200 and Total comparable monthly cost of outsourcing/Buy-in is ₹1,30,100. There is overall saving of ₹6,100, but since there is no tie-in between products, hence decision on all products whether can be outsourced or produced in-house can be taken individually.

The above calculation suggests that only **P-102** and **P-104** can be sourced through outsourcing due to, whereas **P-101**, **P-103** and **P-105** can be produced more cheaply in-house.

(*)

Since avoidable in nature, hence relevant for decision making. ₹2,40,000 is annual cost, hence monthly fixed overhead expenditure will be ₹20,000.

However, following aspects needs to be kept in mind, prior to entering to outsourcing arrangement of product P-102 and P-104

Issue 1

If products **P-102** and **P-104** are outsourced, the company would then have spare capacity. Since the production function/capacity is a limiting factor and there is scope of selling the further units of **P-101**, **P-103** and **P-105**; in order to acquire the market share. Hence, spare capacity is of great importance and will be a powerful argument for outsourcing.

Issue 2

The reaction of the workforce at MSMF is also need to be considered because of two reasons;

- If production of **P-101**, **P-103** and **P-105** cannot be expanded to take up the spare capacity on account of out-sourcing of **P-102** and **P-104**, then lay-off may be required – Which may cause problem like strike by remain workforce or an industrial dispute.
- Facts also suggest that products **P-102** and **P-104** are labour intensive (due to high comparative high labour cost). Hence, even the spare capacity on account of out-sourcing of **P-102** and **P-104** is used, and then also the some of labour forces need to be retrenched.

Issue 3

Even if lay-off is accepted by workforce, then also cost associated with redundancies may be critical. Such cost is relevant for decision-making, hence should be considered.

Issue 4

Since the MSMF has no experience in the outsourcing till now, hence while dealing with Protease, MSMF need to ensure;

- a. Timely delivery in right quantity
- b. Quality of supplies
- c. Penalties in case of default

(ii) Gain Sharing Arrangement by MSMF as part of outsourcing agreement with Protease

Gain Sharing Arrangement is a contractual arrangement where, entity (MSMF) & outsourcing supplier (In this case protease) share the financial gain which result out of either productivity gains or increased efficiency at end of outsourcing supplier from continuous improvement, transformation, or innovation.

This arrangement in form of clause is usually included in Master Agreement of outsourcing. Outsource supplier find it unique selling point and entity is also on for continuous improvement apart this both will get share in cost saved.

Although gain sharing arrangement is largely useful in case of outsourcing services agreement, but MSMF can also while entering out-sourcing contract with Protease for **P-102** and **P-104**; but following aspects need to be considered;

Reason of failure of Gain Sharing Arrangement - Gain Sharing Arrangement sounds great but in practice it is quite difficult to execute. Even after a considerable level of efforts due to following reasons it may fail;

- a. Unstructured/Poorly structured terms of arrangement, in outsourcing contracts.
- b. Error in implementation.
- c. Relationship between outsource supplier and entity.

Precaution need to be taken - Action plan for executing gain share arrangement must contain;

- a. Be specific in outsourcing agreement.
- b. Predefined formula for sharing of benefits and period thereof.
- c. Effort from entity, because innovation is not only responsibility of outsource supplier.
- d. Constitute innovation team to create an innovation structure, generate the idea and execution of same.

Overall

In consideration of above analysis, company should consider the outsourcing of **P-102** and **P-104** by entering out-sourcing contract with Protease. At this point, it is important to note that cost analysis emphasizes purely quantitative, financial considerations. However, outsourcing decisions are often influenced by qualitative factors, which are not directly affected in calculations. The impact of the same should also be taken into consideration. The issues suggested above are not exhaustive. Further, before opting gain sharing arrangement, the same should also be reviewed carefully from a business, legal, and tax perspective.

I hope this helps - if you need any further information, please let me know.

Closure of Report

Mr. Singh,
Management Accountant
(For Management Accounting Division)
Mount Sports Manufacturing Facilities (MSMF)



CS → 14-15



TEST YOUR KNOWLEDGE

Pricing and Product Life Cycle

- Swift Tech Ltd. (STL) is a leading IT security solutions and ISO 9001 certified company. The solutions are well integrated systems that simplify IT security management across the length and depth of devices and on multiple platforms. STL has recently developed an Antivirus Software and company expects to have life cycle of less than one year. It was decided that it would be appropriate to adopt a market skimming pricing policy for the launch of the product. This Software is currently in the Introduction stage of its life cycle and is generating significant unit profits.

Required

- EXPLAIN, with reasons, the changes, if any, to the unit selling price that could occur when the Software moves from the Introduction stage to Growth stage of its life cycle.
 - Also, IDENTIFY necessary strategies at this stage.
- Angel Ltd. is a leading company in the Footwear Industry. The company has four factories in different locations with state of the art equipments. Due to competition in the market, company is continually reviewing its product range and enhancing its existing products by developing new models to satisfy the demands of its customers.

The company currently has a production facility which has a capacity of 3,500 standard hours per week.

Product 'Comfort' was introduced to the market six months ago and is now about to enter the maturity stage of its life cycle.

However, research by the marketing department indicates that demand of the product 'Comfort' in the market is price sensitive. The likely market responses are as follows:

Selling price per unit (₹)	1,750	1,600	1,525	1,450	1,300
Sales demand per week (units)	550	725	1,000	1,150	1,200

The variable cost per unit of manufacturing 'Comfort' is ₹750.

Standard hours used to manufacture one unit is 2 hours.

Product 'Sports' was introduced to the market two months ago using a penetration pricing policy and is now about to enter its growth stage. Each unit has a variable cost of ₹545 and takes 2.50 standard hours to produce. Market research has indicated that there is a linear relationship between its selling price and the number of units demanded, of the form $P = a - bx$. At a selling price of ₹1,000 per unit demand is expected to be 1,000 units per week. For every ₹100 increase in selling price the weekly demand will reduce by 200 units and for every ₹100 decrease in selling price the weekly demand will increase by 200 units.

Product 'Ethnic' is currently being developed and which is about to be launched in the market. This is a highly innovative designer product which the company believes that it will have a revolutionary impact on the market and consumer behaviour. The company has decided to use a market skimming approach to pricing this product during its introduction stage.

Required

- (a) (i) ADVISE which of the above five selling prices should be charged for product 'Comfort', in order to maximize its contribution during its maturity stage.
- (ii) CALCULATE the number of units to be produced of product 'Sports' in order to utilize all of the spare capacity from your answer to (i) above and the selling price per unit of product 'Sports' during its growth stage.
- (b) COMPARE penetration and skimming pricing strategies during the introduction stage, using product 'Ethnic' to illustrate your answer.
- (c) EXPLAIN with reasons, for each of the stages of 'Ethnic's product life cycle, the changes that would be expected in the
 - (i) average unit production cost
 - (ii) unit selling price

Profit Maximization Model

3. Baithway India Ltd. (BIL) is an ISO 9001:2008, a premier multi-discipline company. BIL manufactures a diverse range of products viz. Pressure Vessels, Wagons, Steel Castings etc. To manufacture Wagons, BIL undertake structural fabrication jobs and manufacturing, retrofitting of EOT crane. It is presently the flagship company of the Baithway Group comprising of renowned companies such as Krishna Agriculture, Chiang Phosphate etc. The Group was launched with the idea of one virtual company with diversified businesses, and is based on four fundamental principles - Collaboration, Sustainability, Inclusiveness and being Global.

Baithway India Ltd. has two Divisions namely, Bogie Division (BD) and Wagon Division (WD) for manufacturing of Wagon. 'BD' manufactures Bogies and 'WD' manufactures various type of Wagons like Freight Wagon, Tank Wagon, Special Wagon etc. To manufacture a Wagon, 'WD' needs 4 Bogies. 'BD' is the only manufacturer of the Bogies and supplies both 'WD' and outside customers. Details of 'BD' and 'WD' for the coming financial year 2019-20 are as follows:

	BD	WD
Fixed Costs (₹)	9,20,20,000	16,45,36,000
Variable Cost per unit (₹)	2,20,000	4,80,000*
Capacity per month (units)	320	12

* excluding transfer costs

Linear relationship between Selling Price and Number of Units Demanded has been given to be $P = a - bx$.

P = Selling Price per unit

a = Selling Price when demand will be zero

b (slope) = Change in Price / Change in Quantity

x = Quantity Demanded

Given, at a Selling Price of ₹1,000 per unit, Quantity Demanded will be 1,000 units per week. For every ₹100, per unit increase / decrease in Selling Price, the Quantity Demanded will decrease / increase by 200 units per week respectively. A ₹500 per unit increase in Selling Price will result in fall of 1,000 units of Sales per week. The Selling Price at which Sales will be Zero i.e. $a = ₹1,500$ per unit.

b (slope) = Change in Price / Change in Quantity = ₹100 / 200 = 0.50

Penetration pricing is most commonly associated with a marketing objective of increasing market share or sales volume, rather than short term profit maximization. Thus, substituting the values in the equation to find the Selling Price of "Sports" when the Quantity Sold is 480 units:

$$\begin{aligned} P &= a - bx \\ &= 1,500 - 0.50 \times (480) \\ &= 1,500 - 240 \\ &= ₹1,260 \end{aligned}$$

Sports should be sold at ₹1,260 per unit during the growth stage.



Alternative- Hours after production of Product 'Comfort' $(3,500 - 1,150 \times 2) = 1,200$ hours to be utilized to produce product 'Sports'.
 $1,200 \text{ hours} / 2.5 = 480 \text{ units}$
 10% increase in selling price will lead to 20% decrease in demand of units of product "Sports". Here we can produce only 480 units which amounts to 52% decrease in units so the selling price should be increased by 26% as per given price demand function. So, the selling price per unit will be 1,260 for 480 units of product "Sports".

- (b) "Ethnic" is given to be a highly innovative product that is about to be launched into the market. The product with unique features that will differentiate it from other products leading to a revolutionary impact on market and customer behavior. There seem to be no competitors providing similar products.

Skimming Price Strategy is adopted to charge high prices in the introduction stage in order to recover costs. Skimming Price will be suitable for "Ethnic" because:

- Market for the product is not yet established. Initially *high promotional expense* may have to be incurred *to create customer awareness* and *build a market* for the product.
- Due to its *innovative feature*, the customers would not mind paying a premium for the unique product offering. Demand would be inelastic.
- The market demand is unknown. Initial capital outlay to produce this product may be high, resulting in *high cost of production*.
- Production and promotional costs in the initial years is likely to be high. Therefore, a higher selling price would help Angel Ltd. *to recover the costs*. Since demand is likely to be inelastic, charging a premium may not be a problem.
- The price can be gradually reduced once the market for the product is established. Competitors may *reverse engineer* and offer similar products, due to which *price may have to be lowered in the long run to retain customers*.

Penetration Pricing is adopted to charge a low price in the initial stage for penetrating the market as quickly as possible. For a new product, this low-price strategy will popularize the product. Once the market is established, the price may be increased. Penetration pricing will be suitable when:

- Demand for the product is *elastic*, more demand when prices are low.
- Large scale production of the product yields *economies of scale*.
- *Threat of competition* requires prices to be set low. It serves as an entry barrier to prospective competitors as well.

Product “Ethnic” is an innovative product that the manufacturer believes will change the whole market once it is launched. A strategy of penetration pricing could be effective in **discouraging potential new entrants** to the market. However, the product is believed to be unique and as such **demand** is likely to be fairly **inelastic**. In this instance a policy of penetration pricing could **significantly reduce revenue** without a corresponding increase in sales. Thus, this strategy is not suitable for “Ethnic”.

(c) **Impact on Unit Selling Price and Average Cost of Production per unit at each stage of “Ethnic” Product Lifecycle**

Introduction Stage

As explained in (b) above, at the Introduction Stage of Lifecycle, due to high cost of production and initial promotion expenditure, the unit cost of production will be high. Using Skimming Price Policy, the unit selling price will also be high.

Growth Stage

This is the second phase of the Life-Cycle, product awareness among customers would result in increased demand. Therefore, scale of production likely to increase. The new market segment would attract competitors, who are like to *reverse engineer* and offer similar products in the market. Promotional activities and marketing activities need to continue to maintain and gain market share.

Accordingly, the unit selling price would reduce from the introduction stage on account of the following reasons:

- Competitors offering similar product would take away the uniqueness feature of “Ethnic”.
- Again, to gain market share, the unit selling price may have to be lowered to make it attractive to a larger segment of customers.

The unit cost of production is also likely to reduce due to the following reasons:

- Increased production would result in increased material procurement from suppliers. *Bulk purchasing discounts* can be negotiated with them to lower cost of production.
- *Learning curve and experience* would enable the labor force to become more efficient. This leads to higher production with the same level of resources leading to cost savings.
- *Larger production batches* due to increase in scale of operations will reduce the unit variable overhead cost.
- *Economies of scale* would result due to fixed overhead cost being spread over larger number of units.

Maturity Stage

The third phase of Product Life-Cycle that is characterized by an established market for “Ethnic”. After rapid growth in sale volume in the previous stages, growth of sales for the product will *saturate*. Competition would be high due to large number of rivals in the market, this may lead to decreasing market share.

It is likely that the price of the product will be lowered further at the maturity stage in a bid to **preserve sales volumes**. The company may attempt to preserve sales volumes by employing an extension strategy rather than reducing the selling price. For example, they may introduce product add-ons to the market that are compatible with “Ethnic”.

Unit production cost will remain constant

- Direct material cost will remain constant. If procurement is lower than the growth phase, it might even lead to slightly higher prices since supplier may not extend bulk discounts.
- The benefits of efficient production due to the effect of learning and experience may also have waned. Therefore, unit labour cost is also likely to remain constant.
- Since scale of production is no longer increasing, the unit variable overhead costs are also likely to remain constant.

Decline Stage

This last stage in the product cycle is characterized by saturated market, declining sales, change in customer’s tastes etc. Profitability may slowly start decreasing with fall in sales.

At the decline stage, Product "Ethnic" is likely to have been **surpassed by more advanced products** in the market and consequently will **become obsolete**. The company will not want to **incur inventory holding costs** for an obsolete product and is likely to **sell "Ethnic" at marginal cost or perhaps lower**.

Sales volumes at the decline stage are likely to be low as the product is **surpassed by new exciting products** that have been introduced to the market. Furthermore, the workforce may be less interested in manufacturing a declining product and may be looking to learn new skills. For both of these reasons, **unit production costs are likely to increase** at the decline stage.

3. (i) Assumed Quotation Price 'P', Quantity 'Q'

The Marginal Cost of a 'Wagon' is ₹13,60,000

(₹2,20,000 × 4 Bogies + ₹4,80,000)

Demand Function for a 'Wagon'

$$P = ₹17,10,000 - (₹50,000 / 2) \times Q$$

$$\text{Revenue (R)} = Q \times [17,10,000 - 25,000 \times Q]$$

$$= 17,10,000 Q - 25,000 Q^2$$

$$\text{Marginal Revenue (MR)} = 17,10,000 - 50,000 Q$$

$$\text{Marginal Cost (MC)} = 13,60,000$$

Profit is Maximum where Marginal Revenue (MR) equals to Marginal Cost (MC)

$$17,10,000 - 50,000 Q = 13,60,000$$

$$Q = 7.00 \text{ units}$$

By putting the value of 'Q' in *Demand Function*, value of 'P' is obtained.

$$P = 17,10,000 - (50,000 / 2) \times Q$$

$$= 17,10,000 - 25,000 \times 7.00$$

$$= ₹15,35,000$$

At ₹15,35,000 unit Quotation Price of a Wagon, the Baithway Company Ltd.'s Profit will be Maximum.

(ii) At 'BD' the Divisional Manager would ensure that Divisional Marginal Revenue should be **equal to** Division's Marginal Cost so that Profit can be Maximum.

$$\text{MR of a Bogies} = \text{MC of Manufacturing a Bogies}$$

$$3,20,000 - 2(10,000 / 30) \times Q = 2,20,000$$

$$Q = 150 \text{ units}$$

Selling Price of a Bogie i.e 'P' is

$$P = 3,20,000 - (10,000 / 30) \times 150$$

$$= ₹2,70,000$$



Test Your Understanding

Differentiate ROI and RI?

Hint

- In the case of ROI division managers are computing and comparing the return of proposed investment with the *existing rate of return of respective division*, whereas in the case of RI the *minimum rate of return (cost of capital)* is used to compute residual income.
- ROI is a *relative measure*, whereas RI is an *absolute measure*.
- In case of ROI, the decision was taken based upon a comparison between two (existing and proposed) earning rates, whereas in the case of RI contribution (earning) is compared with cost. Hence, it may possible ROI and RI may give *contradictory results* (see the next example).

Example

The following data pertain to two divisions. W_1 and W_2 , of a large Shipping Company.

	W_1 (₹)	W_2 (₹)
Profit	1,20,00,000	31,20,000
Investment	9,60,00,000	1,56,00,000

Cost of Capital at 10%

Note - This example shows that RI is subject to a **size effect**, but ROI is not. The larger size for the W_1 Division (which is more than 6 times that of the W_2 Division) overcomes its lower profitability, as measured by ROI. Thus, RI is not a good way to compare divisions that differ greatly in size.

Workings

	W_1	W_2	Remark
ROI	12.50% (₹1,20,00,000 / ₹9,60,00,000)	20.00% (₹31,20,000 / ₹1,56,00,000)	W_2 division has the higher ROI.
RI	₹24,00,000 (₹1,20,00,000 - 0.1 × ₹9,60,00,000)	₹15,60,000 (₹31,20,000 - 0.1 × ₹1,56,00,000)	W_1 division has the higher RI.

It can be clearly seen W_2 which outperform the W_1 in measure of ROI, has the disadvantage of size effect which is a shortcoming of RI.

Illustration 1

LNG Limited has three divisions. Its desired rate of return is 14%.

The operating assets and income for each division are as follows:

Divisions	Operating Assets (₹)	Operating Income (₹)
L	19,20,000	3,45,600
N	10,50,000	1,73,250
G	12,30,000	1,67,280
Total	42,00,000	6,86,130

LNG Limited has ₹8,00,000 of additional cash to invest in one of its divisions.

The divisional managers have identified investment opportunities that are expected to yield the following ROIs–

Divisions	Expected ROIs for additional investment
L	16%
N	12%
G	15%

Required

- CALCULATE ROIs at present for each division and STATE which division manager is currently providing the highest ROI.
- Based on ROI, IDENTIFY the division manager who would be the most eager to accept the additional investment funds.
- Based on ROI, IDENTIFY the division manager who would be least eager to accept the additional investment funds.
- STATE the division that offers the best investment opportunity for LNG limited.
- DISCUSS the conflict between requirements (ii) and (iv) above.
- ADVISE how the residual income performance measure could be used to motivate the managers to act in the best interest of the company.

Solution

- Present ROI of each division

Divisions	Operating Assets (₹)	Operating Income (₹)	ROI
L	19,20,000	3,45,600	18%
N	10,50,000	1,73,250	16.5%
G	12,30,000	1,67,280	13.6%

The division manager of L division is currently providing the highest ROI of 18% among the three divisions.

- The manager of division G would be most eager to accept the additional fund of ₹ 8,00,000 because of ROI of the proposed investment is more than the present ROI of 13.6% and the acceptance of the proposal would increase the division's ROI.
- The managers of division L and N, both would be reluctant to invest the additional fund of ₹ 8,00,000. Because the return on the proposed project is 16% for L and 12% for N against their existing ROI of 18% and 16.5% respectively.

However, the manager of division N would be least likely to accept the additional investment because the proposed ROI of the project is 4.5% less than present ROI.

- Division L offers the best investment opportunity of 16% for LNG limited.
- Lack of goal congruence between divisions and organisation as a whole is the reason. The divisional managers are forced to choose between the best interests of their division (because their individual performance is linked to division performance) and the best interests of the company as a whole.

In requirement (ii) decision of managers of division G is in the best interest of the division but at the expense of their company, resulting sub optimisation; whereas in requirement (iv) decision is taken from the perspective of LNG limited as a whole.

- (vi) To avoid sub optimisation, the divisional performance can be measured using Residual Income (RI). Since under RI divisional managers don't reject the proposed projects with lower returns than existing rate of return of division, hence in the interest of organisation as a whole division is ready to accept the investment projects with the returns equal to or greater than the predetermined required rate of return (i.e. 14%). RI being absolute measures have shortcoming too that performance of divisions with different sizes can't be compared.

Economic Value Added (EVA)

Joel Stern and Bennett Stewart the founders of New-York based consulting firm 'Stern Stewart & Company' during the 1990s promoted the EVA. EVA is a performance measurement system that aims to overcome the limitations of other divisional performance measures which are based upon accounting profit. The major shortcomings of relying upon accounting profit include—

- Profit ignores the cost of equity capital. Companies only generate wealth when they generate a return in excess of the return required by providers of capital – both equity and debt. In financial statements, the calculation of profit does take into account the cost of debt finance, but ignores the cost of equity finance.
- Profits calculated in accordance with accounting standards do not truly reflect the wealth that has been created, and are subject to manipulation by accountants.

An alternate to accounting profit is economic profit and EVA is a measure of economic profit.

Calculation of EVA

Economic Value Added is a measure of economic profit. Economic Value Added is calculated as the difference between the Net Operating Profit After Tax (NOPAT) and the Opportunity Cost of Invested Capital. This opportunity cost is determined by multiplying the Weighted Average Cost of Debt and Equity Capital (WACC) and the amount of Capital Employed.

$$\text{EVA} = \text{NOPAT} - \text{WACC} \times \text{Capital}$$

Where- NOPAT means net operating profit after tax. This profit figure shows profits before *taking out the cost of interest*.

Two approaches to adjusting for interest are taken.

- *Start with operating profit*, then deduct the adjusted tax charge. The tax charge should be adjusted because it includes the tax benefit of interest. Since interest is a tax-deductible item, having interest in the income statement means that the tax charge is lower. Since we are taking the cost of interest out of the income statement, it is also necessary to remove the tax benefit of it from the tax charge. To do this, multiply the interest by the tax rate, and add this to the tax charge, *or*
- *Start with profit after tax*, and add back the net cost of interest. This is the interest charge multiplied by (1 – rate of corporate tax).

Illustration 3

Standard Telecom Ltd. is a leading cellular service provider having a global presence. It aims to be the most innovative and trusted telecom company in the world. To achieve this aim, it is constantly working on its overall functioning. It is trying to adopt the best managements practices in the world. Following are some information related to the company's performance for a particular period:

Particulars	Current Year	Base Year	Target
Operating Ratio	60%	54%	Reduce it to 50%
Average Revenue per user	₹ 225	₹ 210	Increase it to ₹ 250
Unresolved Consumer Complaints	27,500	25,000	Reduce it by 20%
Customer Relationship Centres	280	200	Take the total to 250
Employee Coverage under Training Programme	10%	8%	At least 15%

Required

ANALYSE the performance of the company using Balance Scorecard approach.

Solution

The balanced scorecard is a method which displays organisation's performance into four dimensions namely financial, customer, internal and innovation. The four dimensions acknowledge the interest of shareholders, customers and employees taking into account of both long-term and short-term goals. The detailed analysis of performance of the company using Balanced Scorecard approach as follows:

(i) **Financial Perspective:** Operating ratio and average revenue will be covered in this prospective.

Company is unable to achieve its target of reducing the operating ratio to 50% instead it has increased to 60%. The company is required to take appropriate steps to control and manage its operating expenses.

The average revenue per user has increased from ₹210 to ₹225 but remains short of targeted ₹250. This is also one of the reasons for the swelled operating ratio. The company can boost up its average revenue per user by providing more paid value-added services because the increasing price is not a fine choice considering the cut-throat competition in the telecom sector.

(ii) **Customer Perspective:** Service complaints will be covered under this perspective.

The company had set a target of reducing unresolved complaints by 20% instead unresolved complaints have risen by 10% $[(27,500-25,000)/(25,000) \times 100]$. It shows dissatisfaction is increasing among the consumers which would adversely impact the consumer's general perception about the company and the company may lose its consumers in long run.

(iii) **Internal Business Perspective:** Establishing customer relationship centres will be covered under this perspective.

The company has established 80 relationship centres in the current period exceeding its target of 50 (250-200) to cater to the needs of existing consumers as well as soliciting new consumers. This shows the seriousness of the company towards consumer satisfaction and would help them in the long run.

- (iv) **Learning and Growth Perspective:** Employee training program is covered under this perspective.

The company had set a target to cover at least 15% employee under its training program but covered only 10%. This could hurt the capabilities of the employees which are needed for long term growth of the organisation necessary to achieve the objectives set in the previous three perspectives. People or the human resource of the company is one of the three principal sources where organisational learning and growth come.



Practical Insight

Qantas Airways Limited

For 2018/19, the Board considered the following key measures of financial, safety, customer and operational performance and the associated targets to be key indicators of performance and drivers of shareholder value. The performance outcomes for these measures are reflected in the CEO's and Executive Management's remuneration outcomes. The table below summarises performance versus target against each scorecard category under the 2018/19 STIP.

Scorecard Category/ Strategic Objective	Measures	Scorecard Weighting 'Target' (Range of Outcomes)	Actual Outcome	Comment
Group Profitability	Underlying Profit Before Tax (PBT)	50% (0–100%)		The Underlying PBT result of \$1,302 million for 2018/19 exceeded the profit threshold, but was less than the target set by the Board. This resulted in a partial contribution to the STIP Scorecard under this measure.
Workplace and Operational Safety	Workplace Safety measures	15% (0-22.5%)		The Qantas Group overall did not achieve its Workplace Safety stretch targets for the year. Within the Group, a number of reporting entities achieved their targets and/or delivered strong year-on-year improvements. For example: Regional Airlines; the Australian Airports and Freight departments of Qantas Airlines; and Jetstar Airways regarding lost work-day case rates. Overall, there was a nil contribution under the Workplace Safety measure.
	Board's assessment of Operational Safety			Operational Safety performance continued to remain strong. The Group maintains a positive reporting culture. Technical Dispatch Reliability across the Group remained strong and there were no on-going or unresolved adverse flight data trends across any Group airline for key operational performance indicators. Therefore, there was an above target contribution under the Operational Safety measure. Overall, there was a partial contribution to the STIP Scorecard under the Workplace and Operational Safety measure.

TEST YOUR KNOWLEDGE

Return on Investment (ROI)

1. "Y" Limited has three autonomous divisions. The divisions are evaluated on the basis of ROI, with yearend bonuses given to divisional managers who have the highest ROI. Operating results of Division II for the last year are given below:

	₹
Sales	2,10,00,000
Less: Variable Expenses	1,26,00,000
Contribution margin	84,00,000
Less: Fixed Expenses	67,20,000
Net Operating Income	16,80,000
Divisional Operating Assets	52,50,000

The company's overall ROI for the last year was 18% (considering all divisions). Division II has an opportunity to add a new product line that would require an investment of ₹30,00,000. Other details of the new product line are as follows:

	₹
Sales	₹ 90,00,000 per annum
Variable Expenses	65% of sales
Fixed Expenses	₹ 25,20,000 per annum
Life cycle of the product line	5 years

Required

- (i) CALCULATE last year's ROI of Division II.
 - (ii) DISCUSS whether the manager of Division II would accept or reject the new product line, if he takes his decision based solely on divisional ROI.
 - (iii) ADVISE how residual income approach can be used as an alternative financial measure for evaluation of managerial performance in the best interest of the company.
2. BYD Alloy Ltd. first opened its door in 1991 for business and now it is a major supplier of metals supporting over a dozen different industries and employs experts to support each industry. These include Wood & Panel Products Manufacturing, Hearth Products, Site Furnishings, Commercial and Residential Construction etc. It has grown through devotion to its customers, dedication to customer service and commitment to quality products. The company has two divisions: Division 'Y' and Division 'D'. Each division work as an investment centre separately. Salary of each divisional manager is ₹7,20,000 per annum with the addition of an annual performance related bonus based on divisional return on investment (ROI). A minimum ROI of 12% p.a. is expected to be achieved by each divisional manager. If

4. Tax Rate is 30.00%
5. Interest charged in the period was ₹163.20 L.
6. In current fiscal year, BC spend ₹80.00 L in Training and Development by leveraging the latest digital technologies including virtual classrooms to deliver highly relevant training to staff at the point of need.
7. Marketing Expenditure has been ₹46.20 L each year for the last two years to build the long- term brand.
8. The total R & D spending was ₹20 L during this year for in- depth study of the TCP/IP protocols. The TCP/IP based products have not been launched yet.
9. BC has paid Tax of ₹260 L while the tax charged per the accounts was ₹269.60 L.
10. Capital employed during the Period (from the statement of financial position):

Opening	₹4,564.00 L
Closing	₹4,802.00 L

Balanced Scorecard

6. Your Bank Ltd., was established on the 30th September, 1940 under the provisions of Co-operative Societies Act by the eminent professionals to encourage self-help, thrift, cooperation among members. Bank was issued Banking License under Banking Regulation Act, 1949 on October 25, 1986 to carry out the Banking Business within the national capital and since then the Bank has been growing continuously. At present, Bank has large number of membership of individuals from different sections. The Bank has 12 branches in the NCT of Delhi. Bank offers 'traditional counter service'. Opening hours are designed to coincide with local market days.

Board of Directors were worried from growing popularity of new style banks. These banks offer diverse range of services such as direct access to executive management, a single point of contact to coordinate all banking needs, appointment banking to save time, free online banking services 24/7, free unlimited ATM access etc.

It has now been decided that the bank will focus on "What Customers Want" and will use a balanced scorecard to achieve this goal.

Required

PRODUCE, for each of the three non-financial perspectives of a 'Balanced Scorecard', an objective and a performance measure that the bank could use with appropriate reason.

7. B. Steels is a leading manufacturer of flat and long products and have state-of-the-art plants. These plants manufacture value added products covering entire steel value chain right from coal mining to manufacturing Pig Iron, Billets, HR Coils, Black Pipe/GI Pipe, Cable Tapes etc. conforming to international standards. The rock-solid foundation combined with nonstop upgradation and innovation has enabled the B. Steels to surpass its goals constantly. Its

vision and values for sustainable growth is balancing economic prosperity and social equality while caring for the planet. It is preparing its balanced scorecard for the year 2020-21. It has identified the following specific objectives for the four perspectives.

▪ Improve post-sales service	▪ Improve employee morale	▪ Improve employee job satisfaction
▪ Increase gross margin	▪ Increase number of customers	▪ Increase profitability of core product line
▪ Increase plant safety	▪ Increase customer retention	

B. Steels has collected Key Performance Indicators (KPIs) to measure progress towards achieving its specific objectives. The KPIs and corresponding data collected for the year 2020-21 are as follows:

Key Performance Indicator	Goal	Actual
Average replacement time (number of days)	2	1.5
Gross margin growth percentage	15%	16%
Number of customers	15,000	15,600
Number of plant accidents	0	2
Percentage of repeat customers	83%	81%
Core product line profit as a percentage of core-product line sales	5%	4.4%
Employee turnover rate (number of employees leaving/ Average number of total employees)	2%	3%
Employees satisfaction rating (1-5, with 1 being the most satisfied)	1	1.2

For preparation of Balanced Scorecard report, the following format has been developed:

B. Steels Balanced Scorecard Report For the year ended March 31, 2021					
Perspective	Objective	KPI	Goal	Actual	Goal Achieved (Yes or No)
Financial	x	x	x	x	x
Customer	x	x	x	x	x
Internal Business Process	x	x	x	x	x
Learning and Growth	x	x	x	x	x

Required

- (i) PREPARE a balanced scorecard report using the above-mentioned format. Place objective under the appropriate perspective heading in the report. Select a KPI from the list of KPIs that would be appropriate to measure progress towards each objective.
- (ii) B. Steels desires to integrate sustainability and corporate social responsibility related KPIs in their balance scorecard to adhere vision and values. ADVISE B. Steels, using TBL framework.

8. History

In 2010, Luxo had monopoly in the eyewear market of America, but the problem with the company was that it was selling variety of eyewear, by putting a big price on it. At present, there is almost nothing that you can't buy online, but at that time there were limited things that you could order online. In 2010, **Arby Signer** Inc. launched a website to sell eyeglasses online. Selling eyewear online and competing with Luxo was a challenge for Arby. Within just 4 years Arby break the monopoly of Luxo and capture the major market of America. People find it really convenient to buy sunglasses and glasses online and get delivery at doorstep. Following the footstep of Luxo, Arby eliminated the middleman from the manufacturing process, launched its own optical lab to have its own manufacturing process. The range of products/services offered by Arby which make different from Luxo include easy buying process, delivery at door step, stylish glasses, customize eyewear glasses, products was sold on the site at very affordable, with a starting range of just \$95 etc.

Mission, Vision & Objectives

<i>Mission</i>	<i>"Improving people's lives with our health care products in a socially cognizant way"</i>
<i>Vision</i>	<i>"To be a trusted health care partner"</i>
<i>Objective</i>	<i>"To offer people designer eyewear at a revolutionary price"</i>

As a mission- based brand, Arby needed a way to instill their team of employees with a passion for the mission. Arby let their employee know 'what they value' and 'what the employee should value' in 'who they are'. This is important to setting up 'what they do' and 'why they do it' as a core foundation of their brand story. Arby also contributes in the *philanthropic work*, it inspires the people with its mission. For every pair of glasses customer pay, Arby donates a pair of glasses to needy person. In December 2021, Arby reported the donation of 9,60,000 pairs of eyeglasses. The company also claims to be 90% carbon neutral.

Extracts from the Balanced Scorecard

Performance Measure	2021 Actual	2021 Target
Financial perspective		
Return on capital employed (ROCE)	13%	14%
Net income	\$95 Millions	\$89 Millions
Customer perspective		
Number of first-time buyers	1,20,000	1,00,000
Customer retention ratio	78%	75%
Number of complaints (per 1,000 customers)	1.5	2
Number of glasses donated to needy people	9,60,000	9,00,000
Internal processes		
Number of business processes re-engineered	110	100
Number of new services made available through online application	2	4
Incidences of fraud on customers' accounts (per 1,000 customers)	3	10
Total CO ₂ emissions (tons)	850	1,100
Learning and growth		
Number of employees trained to instruct retailers	1,000	1,050
Number of hours (paid for) used to support social plans	10,200	10,000
Number of trainee positions from rural areas	189	200

Other Information

Arby Signer has recently invested heavily in IT security to prevent fraud.

Required

EXAMINE the performance of The Arby Signer in 2021.

Triple Bottom Line (TBL)

- Caregiver Ltd. is a multi-specialty hospital in a mid-sized town. A 300+ bedded facility offers treatment across all medical disciplines of Cardiac, Oncology (Medical, Surgical and Radiotherapy), Neurosciences, Urology, Nephrology, Kidney Transplant, Aesthetics and Reconstructive Surgery, and other ancillary services. Most of the community members have their livelihood linked with the hospital. Many of them are directly employed at the hospital as doctors, nursing staff, lab technicians or as other support staff. While, others are indirectly related as suppliers of medical devices or drugs to the hospital, catering or housekeeping contractors etc. for the hospital. Hence, existence of the hospital is vital to the community.

6. Internal Business Process Perspective

Objective: Cross-sell Products

Measure: Products Purchased *per customer*

Reason: Cross-selling, or encouragement customers to purchase additional products e.g. insurance, forex etc. is a *measure of customer satisfaction*. Only if a service is perceived as highly satisfactory the service would be repeated/ additional products or services would be accepted.

Learning and Growth Perspective

Objective: Increase the Number of New Products or Services Sold

Measure: Number of Customers Buying the New Products/ New Services

Reason: Long term financial success requires bank to create new products / services (e.g. internet banking, ATM access) that will meet emerging needs of current / future customers such as 24/7 banking.

Customer Perspective

Objective: Increase Customer Loyalty

Measure: Number of Accounts Closed or Closure Request Received

Reason: Customer loyalty describes the extent to which bank maintains durable relations to its customers. The share of existing customers should have a high importance as it indicates about image and reputation. Closure request is not a good sign for bank. Bank should investigate reasons for the same and take appropriate actions to improve services offered to retain customers.



Other **Objectives** and **Measures** are also possible but they must relate to the bank's **Goal**.

7. (i)

B. Steels

Balanced Scorecard Report

For the year ended March 31, 2021

Perspective	Objective	KPI	Goal	Actual	Goal Achieved (Yes or No)
Financial	Increase Gross Margin	Gross margin growth percentage	15%	16%	Yes
	Increase Profitability of Core Product Line	Core product line profit as a percentage of core product line sales	5%	4.4%	No

Customer	Increase number of customers	Number of Customers	15,000	15,600	Yes
	Increase customer retention	Percentage of repeat customers	83%	81%	No
Internal Business Process	Improve post sales service	Average replacement time (number of days)	2.0	1.5	Yes
	Increase plant safety	Number of plant accidents	0	2	No
Learning and Growth	Improve employee job satisfaction	Employees satisfaction rating (1-5, with 1 being the most satisfied)	1	1.2	No
	Improve employee morale	Employee turnover rate (Number of employees leaving/ Average number of total employees)	2%	3%	No

- (ii) “Triple Bottom Line” concept encourages companies to measure not only their *financial profits*, but also the impact that its operations have on the *society* and *environment*. Therefore, this framework measures the full cost of doing business by measuring the following bottom lines (i) Profit (ii) People and (iii) Planet.

Diminishing non-renewable resources have forced businesses to focus on *sustainable manufacturing*. This term refers to managing manufacturing processes such that they *minimize any negative impact on the environment* by conserving energy and natural resources. In many instances, improved operational efficiency not only reduces waste (thereby costs) but also improves product safety, it strengthens the *brand's reputation* and builds *public's trust* about the company. As a long- term strategy, this improves *business viability* and provides a *competitive edge* to the company. This concept is the “**Planet Bottom Line**” within the Triple Bottom Line framework. Metrics on the following aspects may be investigated to find out the *environment impact* of business operations:

- Material consumption
- Energy consumption
- Water utilization
- Emissions, treatment of effluents and waste (include emissions affecting air, water, and land)
- Fuel consumption by tracking freight and transportation costs
- Land utilization
- Recyclability and disposal of product

“Corporate Social Responsibility” enables the company to become conscious of the impact its operations has on the society. CSR programs, through philanthropy and volunteer efforts can forge a stronger bond between *itself, its employees*, and the *wider community*. Again, this improves both the *brand image* as well as builds *public’s trust* about the company. This concept is the “**People Bottom Line**” of the Triple Bottom Line framework. Metrics on the following aspects maybe investigated to find out the *social impact* of business operations:

- Work place environment and labour relations
- Occupational health and safety, accident rates
- Human rights practices – child labour, employee work-place security policies
- Training and education
- Equal opportunity employer – diversity of workforce and opportunities available for employees’ growth
- Suppliers – local sourcing versus sourcing from external markets
- Philanthropy and volunteer programs organized
- Product safety in terms of customer health and safety
- Pricing of essential products to enable wider reach within the society
- Transparent and ethical business practices

B. Steels can study these aspects, determine the relevant metrics, and prepare periodic KPI reports that can help in measuring responsibilities towards sustainability and social impact.

8. The balanced scorecard approach looks both financial performance and non-financial performance. In order to gain competitive advantage, organizations have to be conscious of the needs and convenience of their customers. The Arby signer has a vision and strategy which goes far beyond just making money. They want to help the community and give something back to customers also. Hence, performance measures which address whether the Arby is being successful in pursuing their vision has been incorporated in Balanced Scorecard. The performance of the Arby will be considered under each of the titles used in the balanced scorecard:

Financial Perspective

The Arby has had a year of diverse achievements when looking at the extent to which it has met its financial targets. Its ROCE shows how efficiently it has used its assets to generate profit for the business. The target of ROCE for the year was 14% but it has only achieved 13% return. The Arby’s Net Income, however, was in fact \$6 million higher than its target, which is good. The most likely reason for the under target ROCE is possibly the investment which Arby has made in IT security. Whilst this may have reduced ROCE, this investment is essentially a good idea as it helps Arby to pursue its mission and will keep customers happy.

Customer Perspective

Regarding its customers, Arby's performance is better in the current year. It has not just exceeded its target sale to first time buyers by 20,000 but also improved its customer retention ratio, which is good for company to pursue its vision of being a trusted healthcare partner.

Customers complaints has reduced from 2 complaints to 1.5 complaints for every 1,000 customers, the exact reason is not clear but it might be because of improved processes and team efforts of employees.

Also, the number of glasses donated exceeded the target. It shows that company has exceeded its target of helping people which is good for the company's reputation.

Internal Processes

Number of business processes within Arby re-engineered has exceeded the target, which is very good and the impact of which may be reflected in the lowering of level of customer complaints. Likewise, the investment to improve IT security has been a great success, with only three incidences of fraud per 1,000 customers reported compared to the target of 10. However, only two new services have been made available via online application, instead of the target of four, which is unsatisfactory. But fortunately, its CO₂ emission is below to the target level.

Learning and Growth

The Arby has succeeded to train its employees to instruct retailers. However, the number of employees trained to instruct retailers are comparatively lesser than targeted, shortfall in training of employees to give instruction to retailers may have an impact on the Arby's failure to meet its target of market expansion.

Number of hours (paid for) used to support social plans are comparatively higher, it results in additional costs which could have contributed to the fact that the Arby did not quite meet its target for ROCE. Further, company has not met aim for helping the rural area as targeted. This may be because the number of candidates applying from these areas was not as high as planned and this situation is beyond company's control.

In general, the Arby Signer had a successful year, meeting many of its targets.

9. Aspects that need to be reported in the TBL report:

S.N.	Aspect	Category on the TBL Report
(i)	Medical staff conduct charity camps every month. Open to all members of the community, who are provided with consultation free of charge.	Social bottom line , as it benefits the local community.
(ii)	Prompt and accurate tax payments based on records maintained without errors or fraud.	Economic bottom line , since tax payments impact an organization's bottom line and money flow.

Behavioural Consequences

4. APC Ltd. has two divisions- Division X and Division Y with full profit responsibility. Division X produces components 'Gex' which is supplied to both division Y and external customers.

Division Y produces a product called 'Gextin' which incorporates component 'Gex'. For one unit of 'Gextin' two units of component 'Gex' and other materials are used.

Till date, Division Y has always bought component 'Gex' from division X at ₹50 per unit since the lowest price at which the component 'Gex' could have been bought by Division Y was ₹52 per unit.

Division X charges the same price for component 'Gex' to both division Y and external customers. However, it does not incur selling and distribution costs when transferring internally.

Division Y has received a proposal from a new supplier who has offered to supply component 'Gex' for ₹47 per unit at least for the next three years.

Manager of Division Y requests the manager of Division X to supply component 'Gex' at or below, ₹47 per unit. Manager of Division X is not ready to reduce the transfer price since the divisional performance evaluation is done based on profit margin ratio of the division.

The following additional information is made available to you :

	Component 'Gex'	Product 'Gextin'
Selling Price per unit	50	180
Less: Variable Costs		
Direct Materials		
Component 'Gex'	-	100
Other materials	12	22
Direct labour	16	13
Manufacturing Overhead	2	5
Selling and Distribution Costs	4	2
Contribution per unit	16	38
Annual fixed costs	₹40,00,000	₹20,00,000
Annual external demand (units)	3,00,000	1,20,000
Capacity of plant (units)	5,00,000	1,50,000

Required

- (i) CALCULATE the present profit of each division and the company as a whole.
- (ii) ANALYSE the impact on the total annual profits of each division and the company as a whole if Division Y accepts the offer of the new supplier.

(iii) In the changed scenario, DISCUSS why the top management should intervene and advise a suitable transfer price for component 'Gex' for resolving transfer pricing conflict which promotes goal congruence through efficient performance of the concerned division.

5. A manufacturer has two divisions, Division A and Division B. Division B produces components that are used by both Division A as well as external customers. Division A gets its entire requirement for the component from Division B.

The annual production capacity of Division B is 1,00,000 units. The division operates at full capacity, with no inventory at the beginning and end of the year. It sells its components to external customers at ₹4,000 per unit. Variable cost of production for the component is ₹2,750. Internally, it transfers its components to Division A factoring any opportunity cost in the form of lost sales. Total sales of Division B were ₹36 crores, of which sales to external customers was ₹20 crores.

As per company policy, demand from Division A has priority over external customers. This year, there was an additional demand from external customers for 18,000 components. However, since Division B operated at full capacity, this demand was not catered to.

Required

- (i) ANALYZE the Sales in terms of ₹ and units made by Division B to both external and internal customers.
- (ii) RECOMMEND the transfer pricing range that would promote goal congruence between Divisions A and B.
- (iii) DISCUSS the effect of changes in external demand on the transfer price for the company, assuming the current policy continues.
6. GL Ltd. is a multiproduct manufacturing concern functioning with four divisions. The Electrical Division of the company is producing many electrical products including electrical switches. This division functioning at its maximum capacity sells its switches in the open market at ₹25 each. The variable cost per switch to the division is ₹16.

The Household Division, another division of GL Ltd., functioning at 70% capacity asked the Electrical Division to supply 5,000 switches per month at the rate of ₹18 each to fit in night lamps produced by it. The total cost per night lamp is being estimated as detailed below;

	₹
Components purchased from outside suppliers	50.00
Switch if purchased internally	18.00
Other variable costs	40.00
Fixed overheads	21.00
Total cost per night lamp	129.00

Situation II

The Pulp Division has idle capacity, so transfers from the Pulp Division to the Carton Division do not cut into normal sales of pulp to outsiders. In this case, the minimum price as far as the Carton Division is concerned is the variable cost per kg of ₹126. This is confirmed in the following calculation:

$$\text{Transfer price} \geq ₹126 + \frac{₹0}{10,000} = ₹126$$

The Carton Division can buy pulp from an outside supplier for ₹189 per kg and would be unwilling to pay more than that for pulp in an internal transfer. If the managers understand their own businesses and are cooperative, they should agree to a transfer and should settle on a transfer price within the range:

$$₹126 \leq \text{Transfer price} \leq ₹189$$

Situation III

Yes, ₹177 is a bona fide outside price. Even though ₹177 is less than the Pulp Division's ₹180 "full cost" per unit, it is within the range and therefore will provide some contribution to the Pulp Division.

If the Pulp Division does not meet the ₹177 price, it will lose ₹5,10,000 in potential profits.

Price per kg	₹177
Less: Variable Costs	₹126
Contribution margin per kg	₹51

10,000 kgs × ₹51 per kg = ₹5,10,000 potential increased profits.

This ₹5,10,000 in potential profits applies to the Pulp Division and to the company as a whole.



For situation III also considered that "the Pulp Division is currently selling only 60,000 kgs of pulp each year to outside customers".

4. (i) Profitability of each division and the company as a whole when Division X supplies 240,000 units of Gex annually to Division Y.

Division Y produces 1,20,000 units of Gextin. Each component of Gextin requires 2 components of Gex that it currently procures from Division X. Therefore, it procures 2,40,000 units of Gex from Division X annually.

Division X has an overall capacity of 5,00,000 units annually to produce Gex. Of this it produces 2,40,000 units for Division Y, which it must first cater to. The remaining 2,60,000 units of Gex is sold to external customers.

Divisional and Overall Profitability of APC Ltd.

Sr. No.	Particulars	Division X			Division Y		Total APC Ltd	
		Per unit of Gex	External Sales	Internal Sales	Total Division X	Per unit of Gextin		External Sales
			2,60,000 units	2,40,000 Units	5,00,000 Units		1,20,000 units	
1	Selling Price	50	1,30,00,000	1,20,00,000	2,50,00,000	180	2,16,00,000	4,66,00,000
2	Less: Variable Cost							
a	Direct Material							
b	Component Gex	---	---	---	---	100	1,20,00,000	1,20,00,000
c	Other materials	12	31,20,000	28,80,000	60,00,000	22	26,40,000	86,40,000
d	Direct Labour	16	41,60,000	38,40,000	80,00,000	13	15,60,000	95,60,000
e	Manufacturing Over-head	2	5,20,000	4,80,000	10,00,000	5	6,00,000	16,00,000
f	Selling and Distribution Costs	4	10,40,000	----	10,40,000	2	2,40,000	12,80,000
	Total	34	88,40,000	72,00,000	1,60,40,000	142	1,70,40,000	3,30,80,000
3	Contribution (Step 1 - 2)	16	41,60,000	48,00,000	89,60,000	38	45,60,000	1,35,20,000
4	Annual Fixed Cost				40,00,000		20,00,000	60,00,000
5	Annual Profit (Step 3 - 4)				49,60,000		25,60,000	75,20,000

Note

Division X does not incur marketing costs on internal sales. Therefore, cost not incurred on transfer of 240,000 units to Division Y.

- (ii) Impact if Division Y accepts to buy 240,000 units of Gex annually from the external supplier at ₹47 per unit of Gex.

Sr. No.	Particulars	Division X				Division Y		Total
		Per unit of Gex	External Sales	Internal Sales	Total Division X	Per unit of Gextin	External Sales	
			3,00,000 units	0 Units	3,00,000 units		1,20,000 units	
1	Selling Price	50	1,50,00,000	-	1,50,00,000	180	2,16,00,000	3,66,00,000
2	Less: Variable Cost							
a	Direct Material							
b	Component Gex	-	-	-	-	94	1,12,80,000	1,12,80,000
c	Other Materials	12	36,00,000	-	36,00,000	22	26,40,000	62,40,000
d	Direct Labour	16	48,00,000	-	48,00,000	13	15,60,000	63,60,000
e	Manufacturing Overhead	2	6,00,000	-	6,00,000	5	6,00,000	12,00,000
f	Selling and Distribution Costs	4	12,00,000	-	12,00,000	2	2,40,000	14,40,000
	Total	34	1,02,00,000	-	1,02,00,000	136	1,63,20,000	2,65,20,000
3	Contribution (Step 1 - 2)	16	48,00,000	-	48,00,000	44	52,80,000	1,00,80,000
4	Annual Fixed Cost				40,00,000		20,00,000	60,00,000
5	Annual Profit (Step 3 - 4)				8,00,000		32,80,000	40,80,000

Analysis

APC Ltd

Overall profitability of APC Ltd. reduces from ₹75,20,000 per annum to ₹40,80,000 per annum. The reduction in profit is therefore ₹34,40,000 per annum. Reasons are:

- (a) The cost of manufacturing Gex is only ₹30 per unit while Division Y is procuring this at ₹47 per unit from an external supplier. Annually this results in a loss of ₹40,80,000 (240,000 units of Gex × ₹17 per unit).
- (b) Since Division X no longer makes Gex for internal sales, it can ramp up its external sales to meet the full annual demand of 300,000 units. This results in extra external sales of 40,000 units annually. Each unit gives a contribution of ₹16 per unit. Therefore, additional contribution from sale of 40,000 units of Gex to external customers is ₹640,000 per annum.
- (c) Therefore, netting both (a) and (b) above, the net loss to the company is ₹34,40,000 per annum.

Division Y

Impact on profit of Division Y, increase from ₹25,60,000 per annum to ₹32,80,000 per annum that is **₹7,20,000** per annum increase. This is due to the savings in procurement cost of Gex for Division Y. Instead of procuring Gex at ₹50 per unit Division Y proposes to buy it at ₹47 per unit externally. For its annual demand of 2,40,000 units of Gex, it **translates to savings of ₹7,20,000 annually in procurement cost for Division Y.**

Division X

Impact on profit of Division X, reduction from ₹49,60,000 per annum to ₹8,00,000 per annum. A substantial reduction of **₹41,60,000** in its divisional profit per year. Division X earns a contribution of ₹20 per unit of Gex from its internal transfer to Division Y. (Selling price ₹50 per unit less variable cost of manufacturing ₹30 per unit). If Division Y procures Gex externally, this would result in an annual loss of ₹48,00,000 in contribution for Division X (240,000 units × ₹20 per unit). However, due to additional external sales of 40,000 units of Gex, Division X can earn an additional contribution of ₹6,40,000 per year (40,000 units of Gex × ₹16 contribution per unit of external sale). Offsetting, this results in a lower contribution **of ₹41,60,000 per annum for Division X.**

This also results in excess capacity of 2,00,000 units per annum in Division X.

- (iii) APC Ltd. can suffer a loss of ₹34,40,000 per annum if Division Y decides to procure Gex from the external supplier. It costs on ₹30 per unit to manufacture Gex internally as compared to ₹47 per unit that Division Y is willing to pay to the external supplier. However, Division X is unwilling to reduce the price from ₹50 per unit since divisional performance is done based on the profit margin ratio of the division. Therefore, the management of the company has to step in to promote goal congruence. If Division Y buys GEX from the external supplier, not only is it costly for the company, it also results in a lot of unused capacity lying idle in Division X.

In the current scenario, one possible way of arriving at an acceptable transfer price range could be:

Division X is currently working at full capacity of 5,00,000 units per annum. Of this production, 2,40,000 units is supplied internally to Division Y while the balance is supplied to external market. The marginal cost of production of Gex is ₹30 per unit. If this were sold externally, it would earn a contribution of ₹16 per unit. **Therefore, the minimum transfer price the Division X would demand = marginal cost of production per unit + opportunity cost per unit = ₹30 + ₹16 = ₹46 per unit of Gex.**

(The other way of looking at this could also be that Division X does not incur any selling and distribution costs on internal transfers. To outside clients it needs to spend ₹4 per unit towards the same. Therefore, to make its price more competitive with the external market, Division X can reduce the price by ₹4 per unit, which it has been recovering from Division Y for a cost it does not incur in internal transfers. Thus, based on its cost structure and the competitive profit margin it earns from external sales, it can price its internal transfers at ₹46 per unit.)

Division Y will be willing to pay the lower of net marginal revenue or the external buy-in price.

The Net Marginal Revenue per unit of Gextin = Selling price per Gextin – (marginal cost for Division Y other than the cost of Gex) = ₹180 - ₹42 = ₹138 per unit of Gextin. This translates that Division Y will be willing to pay upto ₹69 per unit of Gex, that it can incur without incurring a divisional loss. Meanwhile, the external buy-in price is ₹47 per unit.

Therefore, the maximum price Division Y will be willing to pay = lower of Net Marginal Revenue or external buy-in price = lower of ₹69 or ₹47 per unit of Gex. Therefore, Division Y will be willing to pay maximum ₹47 per unit of Gex to Division X.

Therefore, the transfer price range can be set between ₹46 - ₹47 per unit of Gex. Division X would then have to compete with the external supplier to retain its internal sales. This would promote more efficient working between Division X and Y. **By selling it at ₹46 per unit, the contribution of Division X would be maintained at ₹16 per unit. For Division Y, the procurement of Gex at ₹46 per unit would be beneficial since it is lower than the external market price. If transfer price set at external market rate ₹47 per unit, Division Y would still be able to improve its profit margin as compared to the original transfer price of ₹50 per unit.**

Given that the marginal cost of manufacturing Gex is only ₹30 per unit, the management has to ensure that production of Gex is made in-house. Performance measure at a divisional level should then not be restricted to financial performance alone (full profit responsibility) and should be accordingly modified to include non-financial / operational measures as well.

5. (i) Sales Analysis of Division B

Total annual capacity and actual production of Division B is 100,000 units of components. Zero inventory implies that sales for the year was also 100,000 units of components. Sales to external customers was ₹20 crores, at ₹4,000 per unit. Therefore, units sold to external customers would be 50,000 units this year (₹20 crores sales / ₹4,000 per unit sale price).

Therefore, internal sales can be derived to be 50,000 units for the year (annual sales 100,000 units less external sales 50,000 units). For the year, value of sales made to Division A is ₹16 crore (Division B's total sales of ₹36 crore less external sales of ₹20 crores).

Had there been no extra demand, opportunity cost for Division B would have been nil. Therefore, transfer price would only be the variable cost of ₹2,750 per unit of component, However, given in the problem, that there was excess demand for 18,000 units of components from external customers, that could not be met since Division B had to give priority to internal demand. Had these sales been made Division B would have earned ₹1,250 per unit contribution (Sale price ₹4,000 per unit less variable cost ₹2,750 per unit). This lost contribution of ₹1,250 per unit is the opportunity cost per unit for Division B. Due to company's policy of giving priority to internal demand, Division B lost a profit of ₹2.25 crore during the year. (18,000 units × contribution of ₹1,250 per unit).

Therefore, internal sales comprises of two parts:

32,000 units of components transferred at variable cost of ₹2,750. This amounts to ₹8.8 crores.

18,000 units of components transferred factoring any opportunity cost = variable cost + contribution per unit = external sale price = ₹4,000 per unit. This amounts to ₹7.2 crores.

Therefore, internal sales = ₹8.8 crores + ₹7.2 crores = ₹16 crores.

Summarizing

External sales are 50,000 units amounting to ₹20 crores annual sales value. Internal sales are 50,000 units amounting to ₹16 crores annual sales value. Transfer price for 32,000 units is at variable cost of ₹2,750 per unit while for 18,000 units is at external sales price of ₹4,000 per unit.

(ii) Transfer Price Range for Divisions A and B

Division A procures its entire demand of 50,000 units from Division B. Out of this, 18,000 units at market price of ₹4,000 per unit while 32,000 units are procured at a lower rate of ₹2,750 per unit. Had Division A procured 32,000 units from the market, the additional cost of procurement would be ₹4 crores {(External price of ₹4,000 per unit less internal transfer price at variable cost of ₹2,750 per unit) × 32,000 units}. Only Division A currently enjoys this benefit of lower procurement cost. Financials of Division B show no profit from such internal transfers. This may skew the performance assessment of the divisions, if it is based primarily on financial metrics of each division. In order, promote goal congruence, some portion of this benefit can be shared with Division B.

Division B will at the minimum want to recover its variable cost of ₹2,750 per unit, while Division A will be ready to pay only up to external market price of ₹4,000 per unit. Therefore, transfer price range can be set between ₹2,750 - ₹4,000 per unit. Division A enjoys lower procurement rate while Division B financial reflect some benefit of transferring components internally to Division A.

(iii) Impact of External Demand on Transfer Price

As per the company's transfer pricing policy, Division B gives priority to demand from Division A. The division has a production capacity of 100,000 units annually. If there is *no external market* for Division B's components, then transfer price for the entire internal transfer would be the variable cost of ₹2,750 per unit plus portion of the fixed cost (if any). This is the minimum cost that Division B would like to recover from Division A.

When there is an *external market*, transfer price would depend on whether Division B had to incur any opportunity in the form of lost sales. When total demand (internal and external) is within production capacity of 100,000 units, the entire demand can be met. There would be *no lost sales* for Division B, no opportunity cost. Therefore, transfer price for the entire internal transfer would be the variable cost of ₹2,750 per unit. This is the minimum cost that Division B would like to recover from Division A.

When there is an *external market*, such that total demand (internal and external) is more than production capacity of 100,000 units, due to priority given to internal transfer, some portion of the external demand might not be met. This would be *lost sales* for Division B, opportunity cost would be the contribution lost from such sales at ₹1,250 per unit. This opportunity cost would be passed onto Division A. As explained in part (ii) above, transfer price range will be from ₹2,750 - ₹4,000 per unit. More lost sales for Division B would keep the average transfer price higher towards ₹4,000 per unit. Lesser lost sales for Division B would keep the average transfer price towards the lower bound of ₹2,750 per unit. Therefore, the proportion of external demand that could not be catered to, would determine the average transfer price. Higher the demand from external customers would drive up the average transfer price within the company.

6. (i) Electrical Division is operating at full capacity and selling its switches in the open market at ₹25 each. Therefore, it can transfer its production internally by giving up equal number of units saleable in the open market. In this situation, transfer price should be based on variable cost plus opportunity cost $\{₹16 + (₹25 - ₹16)\} = ₹25/-$.

As the price quoted by Household Division ₹18 is less than the transfer price based on opportunity cost, the Electrical Division should not accept internal transfer. Further, the company is measuring divisional performances based on ROI. Therefore, transferring for a price which is less than the minimum price would affect the return on investments and divisional performance severely.

- (ii) In the total cost per night lamp, the Fixed Overheads being a fixed cost is not relevant for decision making. Similarly, the variable cost of switch (₹16 p.u.) included in the cost of night lamp is also irrelevant as it is common for both internal and external transfers. The only relevant cost is the loss of revenue when units are transferred internally.

Accordingly, the benefit from internal transfer would be $\{₹130 - (₹50 + ₹40) - ₹25\} = ₹15/-$ on each unit sale on night lamp. Therefore, it is beneficial to the company as a whole to the extent of ₹15 per unit of night lamp sold.

Hence, internal transfer is profitable to the company as a whole. Further, Household Division is operating at 70% capacity and has experienced workers which may be utilized for other divisions requirements if any and based on contribution earned fixed cost could be minimized due to large scale of production.

- (iii) Internal transfer pricing develops a competitive setting for managers of each division, it is possible that they may operate in the best interest of their individual performance. This can lead to *sub-optimal utilization of resources*. In such cases, transfer pricing policy may be established to promote goal congruence. The market price of ₹25 per switch leaves Electrical Division in an identical position to sale outside. Thus, ₹25 is top of the price range. Division Household will not pay to Electrical Division anything above $(₹130 - ₹50 - ₹40) = ₹40/-$. The net benefit from each unit of night lamp sold internally is ₹15. Thus, any transfer price within the range of ₹25 to ₹40 per unit will benefit both divisions. Divisional Managers should accept the inter divisional transfers in principle when the transfer price is within the above range.

- Activity Based Costing in Advanced Manufacturing Environment – In advanced manufacturing environment, where support function overheads constitute a large share of total costs, ABC provides more realistic and accurate product costing.
- Activity Based Cost Management (ABM) – A discipline that focuses on the management of activities as the route to improving the value received by the customer and the profit achieved by providing this value. This discipline includes cost driver analysis, activity analysis, and performance measurement.
- Value-Added Activities (VA) – The VA activities are those activities which are indispensable in order to complete the process. The customers are usually willing to pay (in some way) for these services. Eg. polishing furniture by a manufacturer dealing in furniture is a value-added activity.
- Non-Value-Added Activities (NVA) – The NVA activity represents work that is not valued by the external or internal customer. NVA activities do not improve the quality or function of a product or service, but they can adversely affect costs and prices. Non-Value Added activities create waste, result in delay of some sort, add costs to the products or services and for which the customer is not willing to pay. Moving materials and machine set up for a production run are examples of NVA activities.
- Difference between ABC and ABM – The ABC refers to the technique for determining the cost of activities and the output that those activities produce. ABM refers to the management philosophy that focuses on the planning, execution and measurement of activities as the key to competitive advantage
- Activity Based Budgeting (ABB) – Activity Based Budgeting is a process of planning and controlling the expected activities for the organisation to derive a cost-effective budget that meets forecast workload and agreed strategic goals.



TEST YOUR KNOWLEDGE

Manufacturing Cycle Efficiency

1. “W” specialises in engineering design and manufacture in the automotive and motorsport industry. “W”’s design team has many years’ experience in the design and development of engine components for the market and high performance engines. Though “W” is performing well, but many a times, the customers complained that they had to wait for long after placing the orders. “W” is interested in cutting the amount of time between when a customer places an order and when the order is completed. For the last year, the following data were reported in respect of Division “D”:

Inspection time = 0.5 days per batch

Process time = 2.8 days per batch

Wait time	=	16.0 days per batch
Queue time	=	4.0 days per batch
Move time	=	0.7 days per batch

Required

- CALCULATE Manufacturing Cycle Efficiency (MCE) and INTERPRET the result.
- STATE what percentage of the production time is spent in non-value added activities.
- CALCULATE the delivery cycle time.
- CALCULATE the new MCE if by using Lean Production all queue time can be eliminated.

Profitability Analysis

- ABC Airlines has two divisions organised as profit centres, the Passenger Division and the Cargo Division. The following divisional informations were given for the year ended 31st March 2021:

Particulars	Cargo Division	Passenger Division	Total
Number of personnel trained	200	800	1,000
Number of flights	350	250	600
Number of reservations requested	Nil	7,000	7,000
Revenue	₹42,00,000	₹42,00,000	₹84,00,000
Operating Expenses (excluding service department charges)	₹36,00,000	₹28,50,000	₹64,50,000
Service Department Charges			
Training	₹3,20,000	₹3,20,000	₹6,40,000
Flight Scheduling	₹1,50,000	₹1,50,000	₹3,00,000
Reservations	₹1,05,000	₹1,05,000	₹2,10,000

The service department charge rate for the service department costs was based on revenue. Since the revenue of both the divisions were the same, the service department charges to each division were also the same.

Required

- COMMENT on whether the income from operations for the two divisions accurately measures performance.
- PREPARE the divisional income statement using the activity bases provided above in revising the service department charges.

Activity	Cost Driver	Cost per unit of Driver (₹)
Order processing	No. of purchase orders	1,300
Visiting customers	No. of customers visited	7,400
Ordinary delivery	No. of ordinary deliveries	2,000
Speed delivery	No. of speed deliveries	6,000

Required

- (i) EVALUATE the customer profitability by calculating the profit per job from each customer.
- (ii) RECOMMEND steps to be taken to improve profitability from less profitable customers.
- (iii) LIST down the service organizations for which customer profitability analysis is useful.
- (iv) EXPLAIN the specific benefits of customer profitability analysis.

Activity Based Cost Management

8. Melody is a manufacturer of musical instruments. The company specializes in manufacture of Piano and Electronic Keyboard instruments. They are both labour-intensive products. Therefore, Melody follows absorbed its production overheads based on direct labour hours.



Piano– Melody's Pianos are of very high quality. Client patronage include professional Piano musicians. Some of these instruments are sold in its standard form. However, musicians particularly the concert players require their pianos to be customized to certain specifications. Customization primarily relates to the acoustic quality of the piano sound. Quality of sound is of paramount importance to musicians as it determines the power and warmth of tone. Each musician has a preference to achieve a special quality of sound. Therefore, no two customized Pianos can be the same. Due to its reputation, Melody receives numerous requests for customization from its customers. Ability to provide customization service sets Melody apart from its competitors.

Customization requires the services of professional craftsmen. They are hired as subcontractors for such work based on the need. These craftsmen perform their services within the factory premises. For this a special work, space is maintained by Melody. Melody charges its customers extra for sub-contracting cost plus 10%. This would cover the actual cost of subcontracting and any incidental overheads incurred. The Board of Melody accepts that this method of billing is very simplistic. It is unsure if the company is recovering the entire cost of providing this customization service.

Electronic Keyboard Instruments– These are instruments manufactured by Melody are home Keyboards that are targeted at young music enthusiasts who are beginning to learn music. They come in standard sizes, comprised of standard components. No customizations are done to Keyboards.

As a performance management expert, the Board wants your advice. The extract below provides the most recent management accounts for the Piano and Keyboard Division.

Figures in ₹

Sr. No.	Particulars	Piano	Keyboard	Total
1.	Number of items manufactured	1,000	10,000	
2.	Sale Price <i>per unit</i>	2,50,000	15,000	
3.	Revenue	25,00,00,000	15,00,00,000	40,00,00,000
4.	Materials	7,50,00,000	3,75,00,000	11,25,00,000
5.	Direct Labour	8,00,00,000	6,75,00,000	14,75,00,000
6.	Subcontracting Cost	3,75,00,000	-	3,75,00,000
7.	Production Overheads	4,50,00,000	65,00,000	5,15,00,000
8.	Total Cost of Production (4+5+6+7)	23,75,00,000	11,15,00,000	34,90,00,000
9.	Gross Profit (3 - 8)	1,25,00,000	3,85,00,000	5,10,00,000

Production Overheads

Figures in ₹

Particulars	Amount
Inspection and Testing	3,45,00,000
Space Maintenance Cost for Subcontracting Work (rent, utilities, 2 support staff to maintain storage)	50,00,000
Other Production Overheads (rest of the utilities, rent, salary of support staff at storage)	1,20,00,000

Required

- (i) DISCUSS the difference in treatment of production overheads under absorption costing and activity based costing.
- (ii) LIST the steps to implement activity based costing within Melody.
- (iii) ASSESS whether activity based costing would be suitable for the Piano and Keyboard Divisions.
- (iv) ADVISE Melody about the activity based management and ways to improve business performance.


ANSWERS/ SOLUTIONS
1. (i) Manufacturing Cycle Efficiency (MCE)

$$= \frac{\text{Processing Time}}{\text{Inspection Time} + \text{Process Time} + \text{Queue Time} + \text{Move Time} + \text{Wait Time}}$$

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 4.0 \text{ days} + 0.7 \text{ days} + 16.0 \text{ days}} = 11.67\%$$

Interpretation

In AKG, the MCE is 11.67%, which means that 88.33% of the time a unit is in process is spent on the activities that do not add value to the product. Monitoring the MCE helps companies to reduce non-value added activities and thus get products into the hands of customers more quickly and at a lower cost.

(ii) Percentage of Time Spent on Non- Value Added Activities

$$= 100\% - 11.67\%$$

$$= 88.33\%$$

(iii) Delivery Cycle Time

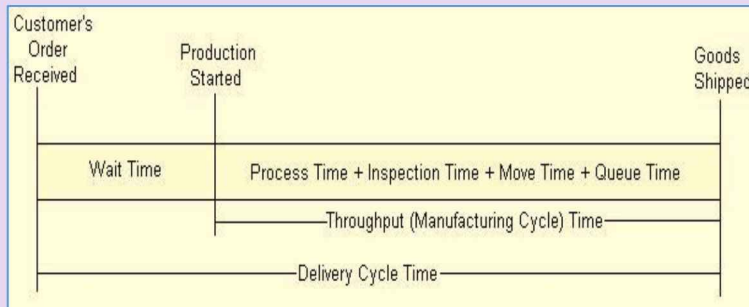
$$= 0.5 \text{ days} + 2.8 \text{ days} + 4.0 \text{ days} + 0.7 \text{ days} + 16 \text{ days}$$

$$= 24 \text{ days}$$

(iv) Revised MCE

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 0 \text{ days} + 0.7 \text{ days} + 16 \text{ days}}$$

$$= 14\%$$

Alternative**(i) Manufacturing Cycle Efficiency (MCE)**

$$= \frac{\text{Value Added Time (Processing Time)}}{\text{Throughput (Manufacturing Cycle) Time}}$$

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 4.0 \text{ days} + 0.7 \text{ days}}$$

$$= 35\%$$

Interpretation

In AKG, the MCE is 35%, which means that 65% of the time a unit is in process is spent on the activities that do not add value to the product. Monitoring the MCE helps companies to reduce non-value added activities and thus get products into the hands of customers more quickly and at a lower cost.

(ii) Percentage of Time Spent on Non- Value Added Activities

$$= 100\% - 35\%$$

$$= 65\%$$

(iii) Delivery Cycle Time

$$= 0.5 \text{ days} + 2.8 \text{ days} + 4.0 \text{ days} + 0.7 \text{ days} + 16 \text{ days}$$

$$= 24 \text{ days}$$

(iv) Revised MCE

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 0 \text{ days} + 0.7 \text{ days}}$$

$$= 70\%$$



Note that MCT does not include the *waiting time* before the “order is received by manufacturing” (i.e. **receipt time**).

Examples of non value added cycle time include the time the product spends waiting for parts or for next stage in the production process, being inspected or repaired or being moved.

This question has been solved in two different ways

Wait time: from start of production to completion

In first way, “Waiting Time” has been considered as the time product spends waiting for parts etc. from the start of production to completion i.e. in the production process. In this case “Waiting Time” is a non- value- added activity and part of MCT and will reduce MCE.

Wait time: from order being placed to start of production

In second way, “Waiting Time” has been considered as the time between ‘customer places order’ and ‘order received by manufacturing department’, in other words it is the time product spends before the production process starts. MCT does not include the *waiting time* before the ‘order is received by manufacturing department’. Therefore, same has not been considered for the MCE calculations.

2. (i) The reported income from operations does not accurately measure performance because the service department charges are based on revenue. Revenue is not associated with the profit centre manager’s use of the service department services. For example, the Reservations Department serves only the Passenger Division and number of reservation requested by Cargo Division is NIL. Thus, by charging this cost based on revenue, these costs are incorrectly charged to the Cargo Division. Further, the Passenger Division requires additional personnel. Since these personnel must be trained, the training costs assigned to the Passenger Division should be greater than the Cargo Division.

- (iii) List of service organizations using customer profitability analysis:
- (a) Financial institutions like Banks and Insurance Companies.
 - (b) Hospitality services like Hotels, Travel Agents, and Tour Operators.
 - (c) Professional services like Audit and Accounting Firms, Law Firms, Consultancy Firms like IT Consultancy, Management Consultancy.
 - (d) Hospitals and Healthcare providers.
 - (e) Logistics and Freight Companies that transport goods to various destinations.

(iv) Benefits of Customer Profitability Analysis:

- (a) It helps the supplier to identify which customers are eroding overall profitability and which customers are contributing to it.
 - (b) It can help to provide a basis for constructive dialogue between buyer and seller to improve margins.
8. (i) Product cost under absorption costing method includes all manufacturing costs that are incurred to produce a product {direct material, labour, and overheads (both fixed and variable)}. The allocation of overhead is determined by a single cost driver based on volume of production (popular ones are machine hours or direct labour hours). This driver is applied to the entire production overhead to arrive at the production overhead rate. For example, in the given problem, labour hours are being used to allocate overheads to Pianos and Keyboards. All production overheads are allocated to products based on this driver irrespective of whether this resource was used by the product or not. For example, production overheads include ***maintenance cost relating to space for subcontracting work***. This cost is incurred for the manufacture of Piano alone. This portion of the maintenance cost gets clubbed with other production costs. Eventually, an overhead absorption rate is calculated using the ratio direct labour hours for each product. Absorption costing would ignore the fact that the manufacture of Keyboards does not utilize the space allocated for subcontracting work. This skews the product costing by erroneously inflating the cost of Keyboards, some portion of the cost of manufacturing Pianos passes onto the product cost for Keyboards. Application of a single cost driver may not be the most appropriate way of allocating costs between products. For example, in the given problem, ***factory rent*** that is clubbed with total overheads and applied to the product cost as part of the overhead rate. Absorption costing ignores that direct labour may not be the most appropriate basis to allocate factory rent overhead to the products.

Activity based costing identifies the cost of each activity and assigns costs to units produced based on the number of activities used by each unit. Instead of being clubbed as a single overhead cost, costs for each activity are captured in their respective cost pools. The most appropriate cost driver is selected. Cost drivers could be volume based

(machine hours / direct labour) or transaction based (# of purchase orders). This cost driver is used as the basis to allocate costs to various products based on the utilization of the resource related to that activity. Overhead costs are assumed to be variable, determined (or driven) by the selected cost driver. Here, the **cost of maintaining space for subcontracting** relates entirely to the manufacture of Pianos. Using ABC method, this cost will be allocated only to Piano products since allocation is now based on utilization of the resource to manufacture the product. Again, under this method, **factory rent** could have space utilization as the cost driver. Therefore, using ABC method, the allocation of rent overhead to the products will be made on a more logical basis as compared to absorption costing.

To conclude, product costing using absorption costing is relatively simpler, a method regularly followed for financial accounting purpose. Product costing using ABC method results in more detailed yet accurate figures. It highlights the cost / benefit of various activities that helps management focus on eliminating non-value added activities.

(ii) **Implementation of ABC Method** within Melody would include the following steps:

Activity Mapping: Production process has to be first broken down into various activities. Based on their nature, activities must then be clubbed to form activity pools. Activity pools must then tie in with the products or services.

Cost Pools: Overheads costs are then identified to each activity pools. This gives the cost pool for each category of activity.

Cost Driver: Identify the activity that bring about the cost. For example, space utilization would be a standard cost driver for factory rent. Cost drivers could be volume based or transaction based.

Overhead Rate: Once the cost pool and cost driver are identified, the cost per unit of cost driver (overhead rate) is determined.

Overhead Cost Allocation: Depending on how much of the resource (cost driver) the product utilizes, the cost is allocated accordingly to that product.

Product Cost: The allocated overhead cost is added to the cost of direct materials and labour to arrive at the full cost of production for the unit.

(iii) **Appropriateness of ABC Method** for the Keyboard and Piano Divisions

The Piano Division receives numerous requests for customization from its customers. While it produces only 1,000 Pianos in a year, no two customizations are the same. Therefore, the range of Pianos manufactured by Melody can be considered varied. Production overheads cost, including subcontracting work, form 35% of the total production cost. $((₹3,75,00,000 + ₹4,50,00,000) / ₹23,75,00,000)$. Therefore, **overheads form a substantial portion of product cost**. Due to the variety in customization, it is important to price each customization at a rate that will yield an acceptable profit margin to Melody. To do this, manufacturing process has to be

segregated into various activities and cost pools. Depending on utilization of resources related to each activity, each Piano can be sold at an appropriate price. If a Piano requires more of a resource from an activity, this can be included in the product cost and factored into the selling price, such that even with customization an acceptable profit margin can be earned. Thus, ABC method can help Melody arrive at a more accurate cost of production as compared to absorption costing.

While, overhead cost is one aspect of ABC analysis, the other information that an organization gets from this framework is that it can identify the activities that add value to the product. At the same time, non-value adding services can be identified (for example storage) and measures can be taken to minimize them. This helps it partner better with its customers and gain a competitive edge.

The Keyboard Division produces 10,000 Keyboards annually, all sold as a standard product with no customization. Activities are standardized, with no variation in the process between the Keyboards. Production overheads form only 6% of total cost of production. (₹65,00,000 / ₹11,15,00,000). Implementation of ABC method is time consuming and complex. Here, due to the standardized nature of production and low quantum of production overheads, ABC method may not be justified for the time and effort involved. In this case, absorption costing may seem to be a more practical approach to arrive at product price.

(iv) **Activity Based Management** to help Melody improve business performance

Activity based management can help Melody to meet the customer needs while using the lowest possible resource or cost. ABM can be used at an operational or strategic level.

Product Pricing

This would be especially in case of the Piano Division. As explained above, ABC method would enable Melody calculate a more accurate cost of production for each Piano. Currently, the **cost of subcontracting work** used for customizing Pianos is ₹3,75,00,000. This is being charged to the customers with a 10% mark-up to cover for any incidental overhead. However, this is very simplistic. As such the mark-up that can be earned under this method will be ₹37,50,000. However, the cost of maintenance of the area for subcontracting work is higher at ₹50,00,000. Therefore, it can be concluded that Melody is not recovering the entire portion of the incidental overheads incurred by providing the subcontracting work.

By identifying the cost pools relating to the subcontracting work, Piano Division can determine that it is making a loss on the subcontract work as a whole. It could therefore adjust the price of customized Pianos such that it earns an acceptable margin on each sale. This is at an operational level. At a strategic level, Melody can determine which type of customizations are most profitable. Customizations that are not very frequent, too complex, and costly may be avoided as it takes away resources from Melody in

terms of labour, space etc. At the same time, careful consideration should be given to such decisions since it is this customization service that gives Melody an edge over other competitors. Therefore, Melody should take decisions that help it balance the customer base, while keeping the costs low and processes as standardized as possible.

Analysis of Activities

Implementation of ABC method forces the company to take a more detailed look at its activities that comprise of its manufacturing process. It may be found that certain activities can be performed in more efficient manner. Also, activities can be identified as that that add value to the product and those that are not value adding. For example, in the given example, **storage** is not a value adding activity. Melody can work on a system where it optimizes the production process such that storage requirements are lower. The inventory turnover of Piano can also be improved, since quicker the Piano is shipped to the customer, lower the space requirement. **Inspection** is another non-value adding activity. For example, Melody switch to a standardized procurement system for its raw materials from reputed suppliers. While it may be a costlier option, this may lead to lower defects in the product, therefore requiring lesser need for inspection.

Performance Measurement

Employee resource should be used more towards value adding activities. Proper training would be required to ensure acceptable quality of work. This would automatically reduce non-value adding activities like rework, idle time, and inspection. There has to be proper information system in place that captures such data. This is facilitated through the implementation of ABC costing method and use of ABM. However, to have a successful system, senior management need to be committed to this model, proper communication and training has to be given to employees. To implement such a performance system the management has to commit sufficient time and effort. Cost benefit considerations of having such systems should also be taken into consideration. To conclude, implementing ABM should not take up productive time of employees and become a non- value activity in itself.

Illustration 4

Well-known Footwear (WF) is a shop that focuses on shoes for various sports and activities like jogging, cricket, tennis, and hockey. Budgeted profit for the WF is calculated considering an average selling price of ₹ 500 per pair of shoes and an average cost of ₹ 350 per pair of shoes. The supervisor of the WF has discretion in staffing and in setting prices. Usually, the WF is staffed for 650 hrs. per month at a budgeted rate of ₹ 125 per hr. In addition to this base wages, sales staff gets a payment equal to 5.5% of takings. Moreover, staffing levels are not expected to change in response to "little" changes in shoe sales. For Sep '2020, the WF had budgeted sales of 2,250 pairs of shoes and 650 staffing hrs. Actual results for Sep '2020 were as follows:

Pairs of shoes sold	2,500
Revenue	12,00,000
Less: Cost of shoes	8,25,000
Less: Staff – additional payment	66,000
Less: Staff – base wages @ ₹ 125 per hour	78,125
Profit	₹ 2,30,875

Note- "little" changes in shoe sales specified as $\pm 12\%$.

Required

- (i) PREPARE a reconciliation statement of budgeted profit to actual profit.
- (ii) COMMENT on supervisor's performance.

Solution**(i) Reconciliation Statement Budgeted and Actual Profit (Sep'2020)**

Budgeted profit	1,94,375
Sales volume variance (F)	30,625
Sales price variance (A)	50,000
Shoe cost variance (F)	50,000
Staff cost variance -commission (F)	2,750
Staff cost variance -base wage (F)	3,125
Actual profit	₹2,30,875

(ii) Comment

The performance seems good. It shows that the supervisor of the WF passed on a 5.7% decrease in shoe cost to customers (same is also revealed through the entirely offsetting of the shoe cost variance and price variance), i.e. shoe costs decreased by ₹20 per pair, from a standard cost of ₹350 per pair to an actual cost ₹330 per pair. Additionally, the selling price decreased by ₹20 per pair, from a standard price of ₹500 per pair to an actual price of ₹480 per pair. In turn, the reduction in the selling price appeared to produce a favourable sales volume variance and a reasonable increase in profit.

Since the reduction in the selling price, staff commissions also were lower than budgeted. Moreover, the ₹50,000 reduction in revenue led to $0.055 \times ₹50,000 = ₹2,750$ less in commission costs.

Lastly, staffing was 25 hours under budget, leading to a savings of $25 \times ₹125 = ₹3,125$. Therefore, the supervisor attained an increase in sales with lesser staff hours.

Overall, it appears that the manager has done a great job of making revenue and controlling costs.

Workings

Statement Showing Budgeted and Actual Profit (Sep'2020)

	Budgeted Data	Actual Data
Units (pairs of shoes)	2,250	2,500
Price per pair of shoes	₹500.00	₹480.00
Cost per pair of shoes	₹350.00	₹330.00
Commission rate	₹27.50 (5.5% of ₹500)	₹26.40 (5.5% ₹480)
Contribution	₹122.50	₹123.60
Revenue	₹11,25,000	₹12,00,000
Less: Cost of shoes	7,87,500	8,25,000
Less: Staff – additional payment (commission)	61,875	66,000
Less: Staff – base wages	81,250	78,125
Profit	₹1,94,375	₹2,30,875

Computation of variances

Total Profit Variance	=	₹2,30,875 – ₹1,94,375 = ₹36,500 (F)
Sales Contribution Volume Variance	=	Standard Contribution – Budgeted Contribution
	=	₹122.50 × 2,500 – ₹122.50 × 2,250
	=	₹3,06,250 – ₹2,75,625 = ₹30,625 (F)
Sales Price Variance	=	Actual Revenue – Standard Revenue
	=	₹480 × 2,500 – ₹500 × 2,500
	=	₹12,00,000 – ₹12,50,000 = ₹50,000 (A)
Shoe Cost Variance *	=	₹350 × 2,500 – ₹330 × 2,500
	=	₹8,75,000 – ₹8,25,000 = ₹50,000 (F)
Staff Cost Variance-commission*	=	₹27.50 × 2,500 – ₹26.40 × 2,500
	=	₹68,750 – ₹66,000 = ₹2,750 (F)
Staff Cost Variance (base wage)	=	₹81,250 – ₹78,125 = ₹3,125 (F).

(*) Note- The cost variance (for both shoe and staff-commission) equal to the difference between the standard cost and the actual cost.

4. AGF is a chemical processing company that produces sprays used by farmers to protect their crops. One of these sprays 'Agrofresh' is made by using either chemical A or chemical B. To produce one litre of Agrofresh spray they have the option to use either 12 litres of chemical A or 12 litres of chemical B. During the financial year, the purchase department of AGF has planned to use chemical B as it appeared that it would be the cheaper of the two and their plans were based on a cost of chemical B of ₹15 per litre.

Due to subsequent market movement during the year the actual prices changed and if the concerned department had purchased efficiently, the cost would have been:

Chemical A	₹15.40 per litre
Chemical B	₹16.00 per litre

Production of Agrofresh spray was 1,000 litres and the usage of chemical B was 12,800 litres at a cost of ₹2,09,920.

You are the CEO of AGF and the management accountant has sent to you the following suggestions through e-mail:

"I feel that in our particular circumstances the traditional approach to variance analysis is of little use as for some of our products we can utilize one of several equally suitable chemicals and we always plan to use such chemical which will lead to cheapest production costs. However due to sharp market movements, we are frequently trapped by the sharp price changes which lead to the choice of expensive alternative at the end."

Required

To check the reality in the content of the mail, you asked, the management accountant of the company:

- (i) to CALCULATE the material variances for Agrofresh by using
 - Traditional Variance Analysis
 - Planning and Operational Variances
- (ii) to ANALYSE how planning and operational variances approached the variances.
- (iii) to ANALYSE how the advanced variances are useful to your organisation.

Variance Analysis in Activity Based Costing

5. Krishna is Chief Financial Officer of millets.com, an internet company that enables customer to order for delivery of different millets by accessing its website. Krishna is concerned with the efficiency and effectiveness of the financial function. He collects the following information for three finance activities in 2020.

Rate per unit of Cost Driver

Activity	Activity Level	Cost Driver	Static Budget Amount (₹)	Actual Amount (₹)
Receivables	Output unit	Remittance	6.39	7.50
Payables	Batch	Invoices	29.00	28.00
Travel expenses	Batch	Travel claims	76.00	74.00

The output measure is the number of deliveries which is the same as the number of remittances. The following additional information are also given:

	Budgeted	Actual
Number of deliveries	10,00,000	9,48,000
Delivery Batch size	5	4.468
Travel expenses Batch size	500	501.587

Required

CALCULATE the flexible budget variances for 2020 to :

- (i) Receivable Activities
- (ii) Payable Activities
- (iii) Travel expense Activities

(Ignore fractions in all calculations)

6. WDG Limited uses activity based costing to allocate variable manufacturing overhead costs to products. The company identified three activities with the following information for last quarter:

Activity	Standard Rate	Standard Quantity per unit produced	Actual Costs	Actual Quantity
Indirect Materials	₹20 per kilogram	0.5 kilogram per unit	₹9,40,000	48,000 kilogram
Product Testing	₹3 per test minute	10 minutes per unit	₹22,50,000	7,40,000 test minutes
Energy	₹0.20 per minute of machine time	4 minutes of machine time per unit	₹70,000	3,60,000 minutes of machine time

The company produced 80,000 units in the last quarter. Company policy is to investigate all variances above 5% of the flexible budget amount for each activity.

Required

- (i) CALCULATE variable overhead expenditure variance and variable overhead efficiency variance for each of the activities using activity based costing. Clearly indicate each variance as favourable or unfavourable / adverse.
- (ii) INTERPRET the results of variable overhead efficiency variance as calculated in (i) above in respect of indirect materials and product testing activity.
- (iii) IDENTIFY the variances that should be investigated according to company policy. Show calculations to support your answer.
7. JPY Limited produces a single product. It has recently automated part of its manufacturing plant and adopted Total Quality Management (TQM) and Just-in- Time manufacturing system. No inventories are held for material as well as for finished product. The company currently uses standard absorption costing system. Following are related to fourth quarter of 2020-21:

	Budget	Actual
Production and Sales	1,00,000 units	1,10,000 units
Direct Materials	2,00,000 kg. @ ₹30/kg	2,50,000 kg. @ ₹31.20/kg.
Direct Labour Hours	25,000 hrs. @ ₹300/ hr	23,000 hrs. @ ₹300/ hr.
Fixed Production Overhead	₹3,20,000	₹3,60,000

Production overheads are absorbed on the basis of direct labour hours.

The CEO intends to introduce activity based costing system along with TQM and JIT for better cost management. A committee has been formed for this purpose. The committee has further analysed and classified the production overhead of fourth quarter as follows:

	Budget	Actual
Costs:		
Material Handling	₹96,000	₹1,24,000
Set Up	₹2,24,000	₹2,36,000
Activity:		
Material Handling (orders executed)	8,000	8,500
Set Up (production runs)	2,000	2,100

Revision of standards relating to fourth quarter were made as below:

	Original Standard	Revised Standard
Material Content <i>per unit</i>	2 kg	2.25 kg
Cost of Material	₹30 per kg	₹31 per kg
Direct Labour Hours	15 minutes	12 minutes

Required

- (i) CALCULATE Planning and Operational Variances relating to material price, material usage, labour efficiency, and labour rate.
- (ii) CALCULATE overhead expenditure and efficiency variance using Activity Based Costing principles.

Reconciliation of Profit

8. Established in the year 1999, **FF Company** is the pioneer of fast food in Southampton. It delivers a truly fresh, affordable, made to order sandwiches, burger, and other meal in a friendly and relaxed environment. The popularity of the sandwiches, burger etc. continued to grow over the decades but one thing remained the same and that was its core values and principles:



- Always provide exceptional service to valued guests;
- Provide the highest quality menu items at a price everyone can afford and enjoy; and
- Keep operating costs low and ensure to have great systems in place and never stop improving.

It provides a comfortable place for people to unwind over interesting conversations. From the beginning, as it continues to grow, it is guided by passion for delighting customers by serving fresh, delicious food right in front of customer.

The performance report* for FY 2020-21 was presented at the management committee meeting as follows:

Particulars	Budget	Actual	Variance
Sales / Production (no. of burgers)	2,00,000	1,65,000	(35,000)
Sales (£)	10,50,000	8,46,450	(2,03,550)
Less: Variable Costs (£)	6,33,000	5,37,075	95,925
Less: Fixed Costs (£)	1,57,500	1,65,000	(7,500)
Profit	2,59,500	1,44,375	(1,15,125)

* *burger segment*

The Management Accountant of FF believed that the size of the fast-food market deriving the budget number of burgers to be sold is over-estimated. He has computed the value of the sales volume contribution planning variance to be 26,062.50 adverse.

Further, the report also included customer's feedback and the majority of comments were regarding delay in service time. One of feedback was as follows:

"I ordered two burgers at 2:10 pm. After half an hour (30 minutes) of waiting I called the waiter and asked him what happened? he told me that he will check with kitchen. I got the order after 45 minutes of waiting, this cafe is not good in delivery time"

The budgeted data shown in the table is based on the assumption that total market size would be 4,00,000 units.

Required

- (iii) PREPARE a reconciliation statement of budgeted profit to actual profit through marginal costing approach in as much detail as possible.
- (iv) EXPLAIN the implications of the reconciliation statement.
- (v) Management is worried about customer's feedback. ADVISE measures to improve delivery service time.

Interpretation of Variances

9. NZSCO Ltd. uses standard costing system for manufacturing its single product 'ANZ'. Standard Cost Card per unit is as follows:

	(₹)
Direct Material (1 kg per unit)	20
Direct Labour (6 hrs @ ₹8 per hour)	48
Variable Overheads	24

Actual and Budgeted Activity Levels in units for the month of Feb'21 are:

	Budget	Actual
Production	50,000	52,000

Actual Variable Costs for the month of Feb'21 are given as under:

Direct Material	10,65,600
Direct Labour (3,00,000 hrs)	24,42,000
Variable Overheads	12,28,000

Required

INTERPRET Direct Labour Rate and Efficiency Variances.

10. T-tech is a Taiwan based firm, that designs, develops, and sells audio equipment. Founded in 1975 by Mr. Boss, firm sells its products throughout the world. T-tech is best known for its home audio systems and speakers, noise cancelling headphones, professional audio systems and automobile sound systems. Extracts from the budget are shown in the following table:

Home Audio System Division

Jan'2021

System	Sales (units)	Selling Price	Standard Cost (per System) ₹
3,000 W PMPO	1,500	18,750	12,500
5,000 W PMPO	500	50,000	26,250

The Managing Director has sent you a copy of an email he received from the Sales Manager 'K'. The content of the email was as follows:

"We have had an outstanding month. There was an adverse Sales Price Variance on the 3,000 W PMPO Systems of ₹ 22,50,000 but I compensated for that by raising the price of 5,000 W PMPO Systems. Unit sales of 3,000 W PMPO Systems were as expected but sales of the 5,000 W PMPOs were exceptional and gave a Sales Margin Volume Variance of ₹ 23,75,000. I think I deserve a bonus!"

The managing Director has asked for your opinion on these figures. You got the following information:

Actual results for Jan' 2021 were:

System	Sales (units)	Selling Price ₹
3,000 W PMPO	1,500	₹17,250
5,000 W PMPO	600	₹53,750

The total market demand for 3,000 W PMPO Systems was as budgeted but as a result of suppliers reducing the price of supporting UHD TV System the total market for 5,000 W PMPO Systems raised by 50% in Jan'2021.

The company had sufficient capacity to meet the revised market demand for 750 units of its 5,000 W PMPO Systems and therefore maintained its market share.

Required

- (i) CALCULATE the following Operational Variances based on the revised market details:
 - Sales Margin Mix Variance
 - Sales Margin Volume Variance
 - (ii) COMMENT briefly on the measurement of the K's performance.
11. Aquatic Feed (AF) is the leading manufacturer of fish and other sea animal feed. AF has made its credit pioneering effort and service for over one decade in development of culture, processing and exports with its state-of-art fish feed and processing plants. Hallmark of AF is constant upgradation of aquaculture technology bringing latest developments in the field to the doorstep of the Indian aquaculture farmer. It stands as a leading provider of high quality feed, best technical support to the farmer and caters to the quality standards of global customers.

One of its fish feed product is "B" which is produced by mixing and heating three ingredients: B₁, B₂ and B₃. It uses a standard costing system to monitor its costs.

The standard material cost for 100 Kg. of "B" is as follows:

Ingredients	Standard Qty. (Kg)	Cost per Kg. (₹)	Cost per 100 Kg. of "B" (₹)
B ₁	42	3	126
B ₂	62	6	372
B ₃	21	2	42
	125		540

Notes

- B₁, B₂ and B₃ are agricultural products. Their quality and price change significantly every year. Standard prices are determined at the average market price over the last three years. AF has a purchasing manager responsible for purchasing and pricing.
- The standard mix is decided by the Managing Partner having 15 years' rich experience in aquaculture field. The last time this was done at time of launching the "B" that was six years back. The standard mix has not been changed since.
- Mixing and heating process are subject to some evaporation loss.

In current month 4,605 Kg. of "B" was produced, using the following ingredients:

Ingredients	Actual Qty. (Kg)	Cost per Kg. (₹)	Total Cost of "B" (₹)
B ₁	2,202	2.8	6,165.60
B ₂	2,502	7	17,514
B ₃	921	2	1,842
	5,625		25,521.60

At every month end, the production manager receives a statement from the Managing Partner. This statement contains material price and usage variances for the month and no other feedback on the efficiency of the processes is provided.

Required

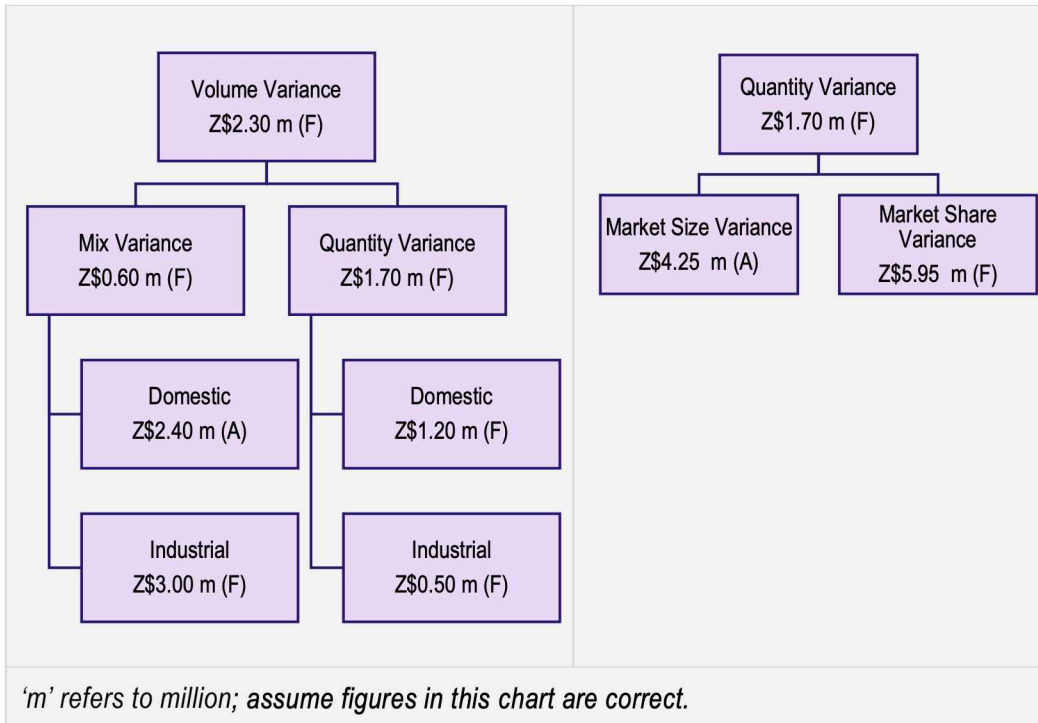
EVALUATE the performance measurement system in AF.

12. ZM Inc. is a family run business based in Country Z. It is a manufacturer of two types of flooring rolls, one for industrial usage and the other for domestic residential use, throughout mainland of Country Z. The company started with the production of residential domestic flooring. It is now an established player in this market. In the recent years, the company pioneered into making flooring rolls for industrial usage. The management has the following information about the budgeted and actual data for 2021-

Particulars	Static Budget			Actual Result		
	Industrial	Domestic	Total	Industrial	Domestic	Total
Unit Sales in Rolls ('000)	200	600	800	270	570	840
Contribution Margin (Z\$ in millions)	10.00	24.00	34.00	12.825	15.390	28.215

In late 2020, a marketing research estimated market volume for industrial and domestic flooring at 8 m Rolls. Actual market volume for 2021 was 7 m Rolls. Actual sales trend of ZM Inc. is indicative of the sales trends for individual products in the future years, it is likely that they might continue to sell a similar sales trajectory.

A newly appointed accountant has computed following variances from the above data:



Required

Assuming yourself as a performance management expert of ZM, the CEO has asked you to:

- ANALYSE the variances computed by the accountant;
- ADVISE strategic inputs on 'two types of flooring rolls' to help out her in strategic decision making.

W.N.4

Statement Showing Planning Variances

Particulars	RM	RM
<i>Planning Variance</i>		
Sales Price [(RM 82.50 - RM 50.00) × 2,000 units]	65,000 (F)	16,500 (F)
Circuit X Price [(RM 2.50 - RM 4.25) × 20,000 units]	35,000 (A)	
Circuit Designer Rate [(RM 2.00 - RM 3.125) × 12,000 hrs.]	13,500 (A)	

4. (i) Traditional Variances

$$\begin{aligned} \text{Usage Variance} &= (12,000 \text{ lt.} - 12,800 \text{ lt.}) \times ₹ 15.00 \\ &= ₹ 12,000 \text{ (A)} \\ \text{Price Variance} &= (₹ 15.00 - ₹ 16.40) \times 12,800 \text{ lt.} \\ &= ₹ 17,920 \text{ (A)} \\ \text{Total Variance} &= ₹ 12,000 \text{ (A)} + ₹ 17,920 \text{ (A)} \\ &= ₹ 29,920 \text{ (A)} \end{aligned}$$

Operational Variances

$$\begin{aligned} \text{Usage Variance} &= (12,000 \text{ lt.} - 12,800 \text{ lt.}) \times ₹ 16.00 \\ &= ₹ 12,800 \text{ (A)} \\ \text{Price Variance} &= (₹ 16.00 - ₹ 16.40) \times 12,800 \text{ lt.} \\ &= ₹ 5,120 \text{ (A)} \\ \text{Total Variance} &= ₹ 12,800 \text{ (A)} + ₹ 5,120 \text{ (A)} \\ &= ₹ 17,920 \text{ (A)} \end{aligned}$$

Planning Variances

$$\begin{aligned} \text{Controllable Variance} &= (₹ 15.40 - ₹ 16.00) \times 12,000 \text{ lt.} \\ &= ₹ 7,200 \text{ (A)} \\ \text{Uncontrollable Variance} &= (₹ 15.00 - ₹ 15.40) \times 12,000 \text{ lt.} \\ &= ₹ 4,800 \text{ (A)} \\ \text{Total Variance} &= ₹ 7,200 \text{ (A)} + ₹ 4,800 \text{ (A)} \\ &= ₹ 12,000 \text{ (A)} \end{aligned}$$

$$\begin{aligned} \text{Reconciliation} &= ₹ 17,920 \text{ (A)} + ₹ 12,000 \text{ (A)} \\ &= ₹ 29,920 \text{ (A)} \end{aligned}$$



Direct Material Usage Operational Variance using *Standard Price*, and the Direct Material Price Planning Variance based on *Actual Quantity* can also be calculated. This approach reconciles the Direct Material Price Variance and Direct Material Usage Variance calculated in part.

- (ii) Traditional variance analysis is applied based on the assumption that whole of the variance is due to operational deficiencies and the planning associated with setting the original standard is perfectly correct. But this assumption is not practical. When the conditions are volatile and dynamic, traditional variances need to be analysed into planning and operational variances. Planning variances try to explain the extent to which the original standard needs to be adjusted to reflect changes in operating conditions between the current situation and that imagined when the standard was originally derived. Planning variances are generally *not controllable and may need to revise to cater the changes due to environmental/ technological changes* at a later stage. In certain situation planning variances can be considered *controllable* as well. Whereas operational variances explain the extent to which adjusted standards have been achieved. Operational variances are calculated after the planning variances have been established and are thus a realistic way of assessing performance. So, it indicates a reality check of traditional variance analysis.

In AGF, as per traditional approach total variances are ₹29,920 (adverse), out of which ₹17,920 (adverse) accounts for total operational variance and ₹12,000 (adverse) is for total planning variance. It is necessary to analyse planning variances further. The planning variance of ₹12,000 (adverse) can be divided into an *uncontrollable* adverse variance of ₹4,800 and a *controllable* adverse variance of ₹7,200. Similarly, total operational variance can be sub classified as adverse price variance of ₹5,120 and adverse usage variance of ₹12,800. This analysis gives a clearer indication of the inefficiency of the purchasing function by the concerned department. Performance of the staff of the purchasing department should be evaluated/ rewarded based on variances which are *controllable*. If an adverse *uncontrollable* variance of ₹4,800 is reported in the performance reports this is likely to lead to dysfunctional motivation effects to the purchase department.

- (iii) In today's cutthroat competition, managers must react quickly and accurately to the changes in technology, price fluctuation, consumer tastes, laws and regulations, economic conditions, political conditions, and international conditions etc. which are changing rapidly and dramatically. Accordingly, management accountant should be able to provide necessary inputs by a proper analysis of the things that pertains to his/her area like effect of changes in price. The unique features of advanced variance analysis are that, it considers *different market conditions and changes in the dynamic environment*.

Moreover, advanced variances classify variances into *controllable* and *uncontrollable* variances and help the management to find out reasons for adverse variances so that corrective action can be taken. Similarly, if any adverse variances have arrived, because of changes in the market condition like inflation, it has to be differentiated from the other variances.

AGF is a type of organization where management of performance can be done only through advanced variance analysis. Advanced variance analysis of AGF shows that it has adverse planning variance as well as adverse operational variance. Further, the emergence of *controllable* and *uncontrollable* variances makes it a perfect case of advance variance analysis in AGF. In AGF, sharp price changes which lead to the choice of expensive alternative and efficiency of purchase department need to be analyzed, reported, and dealt separately by the joint effort of the management accountant and the top management. Hence, advanced variance analysis in AGF is an absolute necessity.

5. Activity-based costing, flexible-budget variances for finance function activities:

(i) Receivables

'Receivables' is an output unit level activity. Its flexible-budget variance can be calculated as follows:

Flexible Budget Variance

$$\begin{aligned}
 &= \text{Flexible Budget Costs} - \text{Actual Costs} \\
 &= ₹6.39 \times 9,48,000 - ₹7.50 \times 9,48,000 \\
 &= ₹60,57,720 - ₹71,10,000 \\
 &= ₹10,52,280 \text{ (A)}
 \end{aligned}$$

(ii) Payables

'Payables' is a batch level activity.

	Static-Budget Amounts	Actual Amounts
a. Number of deliveries	10,00,000	9,48,000
b. Batch size (units per batch)	5	4.468
c. Number of batches (a / b)	2,00,000	2,12,175
d. Cost per batch	₹29	₹28
e. Total payables activity cost (c×d)	₹58,00,000	₹59,40,900

Step 1: The number of batches in which payables should have been processed

$$\begin{aligned}
 &= 9,48,000 \text{ actual units} / 5 \text{ budgeted units per batch} \\
 &= 189,600 \text{ batches}
 \end{aligned}$$

Step 2: The flexible-budget amount for payables

$$= 1,89,600 \text{ batches} \times ₹29 \text{ budgeted cost per batch}$$

$$= ₹54,98,400$$

The flexible-budget variance can be computed as follows:

Flexible-Budget Variance

$$= \text{Flexible-Budget Costs} - \text{Actual Costs}$$

$$= 1,89,600 \times ₹29 - 2,12,175 \times ₹28$$

$$= ₹54,98,400 - ₹59,40,900$$

$$= ₹4,42,500 \text{ (A)}$$

(iii) Travel Expenses

Travel expenses is a batch level activity.

	Static-Budget Amounts	Actual Amounts
a. Number of deliveries	10,00,000	9,48,000
b. Batch size (units per batch)	500	501.587
c. Number of batches (a / b)	2,000	1,890
d. Cost per batch	₹76	₹74
e. Total travel expenses activity cost (c×d)	₹1,52,000	₹1,39,860

Step 1: The number of batches in which the travel expense should have been processed

$$= 948,000 \text{ actual units} / 500 \text{ budgeted units per batch}$$

$$= 1,896 \text{ batches}$$

Step 2: The flexible-budget amount for travel expenses

$$= 1,896 \text{ batches} \times ₹76 \text{ budgeted cost per batch}$$

$$= ₹1,44,096$$

The flexible budget variance can be calculated as follows:

Flexible Budget Variance

$$= \text{Flexible-Budget Costs} - \text{Actual Costs}$$

$$= 1,896 \times ₹76 - 1,890 \times ₹74$$

$$= ₹1,44,096 - ₹1,39,860$$

$$= ₹4,236 \text{ (F)}$$

6. (i) **Indirect Materials**

Efficiency Variance	=	Cost Impact of <i>undertaking activities</i> more/ less than <i>standard</i>
	=	$(0.50\text{kg.} \times 80,000\text{units} - 48,000\text{ kg.}) \times ₹20$
	=	₹1,60,000 (A)
Expenditure Variance	=	Cost impact of paying more/ less than standard for actual activities undertaken
	=	$48,000\text{kg.} \times ₹20 - ₹9,40,000$
	=	₹20,000 (F)

Product Testing

Efficiency Variance	=	Cost Impact of <i>undertaking activities</i> more/ less than <i>standard</i>
	=	$(10\text{ mins.} \times 80,000\text{ units} - 7,40,000\text{ mins.}) \times ₹3$
	=	₹1,80,000 (F)
Expenditure Variance	=	Cost impact of paying more/ less than standard for actual activities undertaken
	=	$7,40,000\text{mins} \times ₹3 - ₹22,50,000$
	=	₹30,000 (A)

Energy

Efficiency Variance	=	Cost Impact of <i>undertaking activities</i> more/ less than <i>standard</i>
	=	$(4\text{ mins.} \times 80,000\text{ units} - 3,60,000\text{ mins.}) \times ₹0.20$
	=	₹8,000 (A)
Expenditure Variance	=	Cost impact of paying more/ less than standard for actual activities undertaken
	=	$3,60,000\text{mins} \times ₹0.20 - ₹70,000$
	=	₹2,000 (F)

(ii) **Indirect Materials**

WDG actually spent 48,000 kg. or 8,000 kg. more than the standard allows. At a predetermined rate of ₹20 per kg., efficiency variance is 1,60,000 (A). Since actual quantity was higher than the standard, the variance is unfavorable. This adverse variance, could have been caused by the inferior quality, result of carelessness handling of materials by production workers or could be as a result of change in methods of production, product specifications or the way in which quality of the product is checked or controlled.

Product Testing

Favorable efficiency variance amounting to ₹1,80,000 indicates that fewer testing minutes were expended during the quarter than the standard minutes required for the level of actual output. This may be due to employment of a higher skilled labor or improvement of skills of existing workforce through training and development leading to improved productivity etc.

(iii) Flexible Budget

Indirect Materials	= (0.50 kg. × 80,000 units) × ₹20 = ₹8,00,000	= ₹8,00,000 × 5% = ₹40,000
Product Testing	= (10 mins. × 80,000 units) × ₹3 = ₹24,00,000	= ₹24,00,000 × 5% = ₹1,20,000
Energy	= (4 mins. × 80,000) × ₹0.20 = ₹64,000	= ₹64,000 × 5% = ₹3,200

Efficiency Variance for all the three activities are more than 5% of their flexible budget amount. So, according to the company policy, efficiency variances should be investigated.

Alternative**Statement Showing Identification of Variances to be investigated**

	Calculation	Variance % of Flexible Budget	Criteria	Investigate Y or N
Indirect Materials				
Efficiency Variance	$\left(\frac{1,60,000}{8,00,000} \times 100 \right)$	20%	5%	Y
Expenditure Variance	$\left(\frac{20,000}{8,00,000} \times 100 \right)$	2.5%	5%	N
Product Testing				
Efficiency Variance	$\left(\frac{1,80,000}{24,00,000} \times 100 \right)$	7.5%	5%	Y
Expenditure Variance	$\left(\frac{30,000}{24,00,000} \times 100 \right)$	1.25%	5%	N
Energy				
Efficiency Variance	$\left(\frac{8,000}{64,000} \times 100 \right)$	12.5%	5%	Y
Expenditure Variance	$\left(\frac{2,000}{64,000} \times 100 \right)$	3.125%	5%	N

7. (i) Workings

Factor	Original Standards (ex-ante)		Revised Standards (ex-post)		Actual (1,10,000 units)	
	Material	1,10,000 units×2 kgs. ×₹30	₹66,00,000	1,10,000 units×2.25 kgs. ×₹31	₹76,72,500	2,50,000 kgs. ×₹31.20
Labour	1,10,000 × 15/60 hrs.× ₹300	₹82,50,000	1,10,000 × 12/60 hrs.× ₹300	₹66,00,000	23,000 hrs.× ₹300	₹69,00,000

Material**Traditional Variances**

$$\begin{aligned} \text{Usage Variance} &= (2,20,000 \text{ Kgs.} - 2,50,000 \text{ Kgs.}) \times ₹30 \\ &= ₹9,00,000 \text{ (A)} \\ \text{Price Variance} &= (₹30.00 - ₹31.20) \times 2,50,000 \text{ Kgs.} \\ &= ₹3,00,000 \text{ (A)} \\ \text{Total Variance} &= ₹9,00,000 \text{ (A)} + ₹3,00,000 \text{ (A)} \\ &= ₹12,00,000 \text{ (A)} \end{aligned}$$

Planning Variances

$$\begin{aligned} \text{Usage Variance} &= (2,20,000 \text{ Kg.} - 2,47,500 \text{ Kg.}) \times ₹30 \\ &= ₹8,25,000 \text{ (A)} \\ \text{Price Variance} &= (₹30 - ₹31) \times 2,47,500 \text{ Kgs.} \\ &= ₹2,47,500 \text{ (A)} \\ \text{Total Variance} &= ₹8,25,000 \text{ (A)} + ₹2,47,500 \text{ (A)} \\ &= ₹10,72,500 \text{ (A)} \end{aligned}$$

Operational Variances

$$\begin{aligned} \text{Usage Variance} &= (2,47,500 \text{ Kg.} - 2,50,000 \text{ Kg.}) \times ₹31 \\ &= ₹77,500 \text{ (A)} \\ \text{Price Variance} &= (₹31.00 - ₹31.20) \times 2,50,000 \text{ Kg.} \\ &= ₹50,000 \text{ (A)} \\ \text{Total Variance} &= ₹77,500 \text{ (A)} + ₹50,000 \text{ (A)} \\ &= ₹1,27,500 \text{ (A)} \end{aligned}$$



Direct Material Usage Operational Variance using *Standard Price*, and the Direct Material Price Planning Variance based on *Actual Quantity* can also be calculated. This approach reconciles the Direct Material Price Variance and Direct Material Usage Variance calculated in part.

Labour

Traditional Variances

$$\begin{aligned}
 \text{Efficiency Variance} &= (27,500 \text{ hrs.} - 23,000 \text{ hrs.}) \times ₹300 \\
 &= ₹13,50,000 \text{ (F)} \\
 \text{Rate Variance} &= (₹300 - ₹300) \times 23,000 \text{ hrs.} \\
 &= \text{NIL} \\
 \text{Total Variance} &= ₹13,50,000 \text{ (F)} + \text{NIL} \\
 &= ₹13,50,000 \text{ (F)}
 \end{aligned}$$

Planning Variances

$$\begin{aligned}
 \text{Efficiency Variance} &= (27,500 \text{ hrs.} - 22,000 \text{ hrs.}) \times ₹300 \\
 &= ₹16,50,000 \text{ (F)} \\
 \text{Rate Variance}^* &= (₹300 - ₹300) \times 22,000 \text{ hrs.} \\
 &= \text{NIL} \\
 \text{Total Variance} &= ₹16,50,000 \text{ (F)} + 0 \\
 &= ₹16,50,000 \text{ (F)}
 \end{aligned}$$

Operational Variances

$$\begin{aligned}
 \text{Efficiency Variance} &= (22,000 \text{ hrs.} - 23,000 \text{ hrs.}) \times ₹300 \\
 &= ₹3,00,000 \text{ (A)} \\
 \text{Rate Variance} &= (₹300 - ₹300) \times 23,000 \text{ hrs.} \\
 &= \text{NIL} \\
 \text{Total Variance} &= ₹3,00,000 \text{ (A)} + 0 \\
 &= ₹3,00,000 \text{ (A)}
 \end{aligned}$$



Direct Labour Efficiency Operational Variance using *Standard Rate*, and the Direct Labour Rate Planning Variance based on *Actual Hours* can also be calculated. This approach reconciles the Direct Labour Rate Variance and Direct Labour Efficiency Variance calculated in part.

(ii) **Material Handling**

Efficiency Variance

= Cost Impact of *undertaking activities* more/ less than *standard*

= (8,800 orders* – 8,500 orders) × ₹12

= ₹3,600 (F)

$$(*) \left(\frac{8,000 \text{ orders}}{1,00,000 \text{ units}} \right) \times 1,10,000 \text{ units}$$

Expenditure Variance

= Cost impact of paying more/ less than standard for actual activities undertaken

= 8,500 orders × ₹12 – ₹1,24,000

= ₹22,000 (A)

Setup

Efficiency Variance

= Cost Impact of *undertaking activities* more/ less than *standard*

= (2,200 runs* – 2,100 runs) × ₹112

= ₹11,200 (F)

$$(*) \left(\frac{2,000 \text{ runs}}{1,00,000 \text{ units}} \right) \times 1,10,000 \text{ units}$$

Expenditure Variance

= Cost impact of paying more/ less than standard for actual activities undertaken

= 2,100 runs × ₹112 – ₹2,36,000

= ₹800 (A)

8. (i) Statement of Reconciliation - Budgeted Vs Actual Profit

Particulars	£
Budgeted Profit	2,59,500
Less: Sales Volume Contribution - Planning Variance (Adverse)	26,062.50
Less: Sales Volume Contribution - Operational Variance (Adverse)	46,912.50
Less: Sales Price Variance (Adverse)	19,800
Less: Variable Cost Variance (Adverse)	14,850
Less: Fixed Cost Variance (Adverse)	7,500
Actual Profit	1,44,375

Workings*Basic Workings*

$$\text{Budgeted Market Share (in \%)} = \frac{2,00,000}{4,00,000} = 50\%$$

$$\text{Budgeted Contribution} = £10,50,000 - £6,33,000 = £4,17,000$$

Average Budgeted Contribution (*per unit*)

$$= \frac{£4,17,000}{2,00,000} = £2.085$$

Volume Contribution Planning = Budgeted Market Share % × (Actual Industry Sales Quantity *in units* – Budgeted Industry Sales Quantity *in units*) × (Average Budgeted Contribution *per unit*)

$$\Rightarrow £26,062.50 \text{ (A)} = 50\% \times (\text{Actual Industry Sales Quantity } in \text{ units} - 4,00,000 \text{ units}) \times £2.085$$

$$\Rightarrow \text{Actual Industry Sales Quantity} = 3,75,000 \text{ units}$$

$$\text{Actual Market Share (in \%)} = \frac{1,65,000}{3,75,000} = 44\%$$

$$\text{Standard Sales Price } per \text{ unit} = \frac{£10,50,000}{2,00,000} = £5.25$$

$$\text{Actual Sales Price } per \text{ unit} = \frac{£8,46,450}{1,65,000} = £5.13$$

$$\text{Standard Variable Cost } per \text{ unit} = \frac{£6,33,000}{2,00,000} = £3.165$$

$$\text{Actual Variable Cost } per \text{ unit} = \frac{£5,37,075}{1,65,000} = £3.255$$

CALCULATION OF VARIANCES**Sales Variances**

Volume Contribution Operational = (Actual Market Share % – Budgeted Market Share %) × (Actual Industry Sales Quantity *in units*) × (Average Budgeted Contribution *per unit*)

$$= (44\% - 50\%) \times 3,75,000 \text{ units} \times \text{£}2.085$$

$$= \text{£}46,912.50 \text{ (A)}$$

Price = Actual Sales – Standard Sales

$$= \text{Actual Sales Quantity} \times (\text{Actual Price} - \text{Standard Price})$$

$$= 1,65,000 \text{ units} \times (\text{£}5.13 - \text{£}5.25)$$

$$= \text{£}19,800 \text{ (A)}$$

Variable Cost Variances

Cost = Standard Cost for Production – Actual Cost

$$= \text{Actual Production} \times (\text{Standard Cost per unit} - \text{Actual Cost per unit})$$

$$= 1,65,000 \text{ units} \times (\text{£}3.165 - \text{£}3.255)$$

$$= \text{£}14,850 \text{ (A)}$$

Fixed Cost Variances

Expenditure = Budgeted Fixed Cost – Actual Fixed Cost

$$= \text{£}1,57,500 - \text{£}1,65,000$$

$$= \text{£}7,500 \text{ (A)}$$

(ii) Implications of Reconciliation Statement

In the revised statement, the sales volume variance has been detailed by the way of two variances i.e. planning and operational variances. This kind of detailed information assists the company to check, which kind of variances are under the management control and which are not. FF has adverse volume contribution planning variance and the reason could be the environmental / market changes, that was not anticipated at the time of budget preparation, so they are not under management control and hence, no one is responsible for this. On the other hand, the sales volume contribution operational variance was under control of the managers and they should be held responsible for the same. The reason of adverse sales volume contribution operational variance could be unsuccessful direct selling efforts/marketing efforts. FF has adverse sales price variance as well. It indicates that the burgers were sold for lower price than standard. The reason of this could be unforeseen market competitive price, tapping new market etc.

Further, revised reconciliation statement delivers little information about the variable cost and fixed cost variances. They both are adverse. Fixed cost consists of many items such as salaries, annual maintenance cost, rent and insurance etc. Often fixed cost items are not affected in short run in response to change in the level of activity, but they might change in response to other factors such as price. This may cause increase expenditure on fixed overheads. A meaningful analysis of fixed cost variance requires a line to line comparison of budgeted cost with actual cost.

In case of FF, the variable cost may be made up of large individual different items such as vegetables, gas, indirect labor, regular maintenance cost etc. Control of variable cost also requires line by line analysis for each individual item. The adverse variable cost variance simply reveals that FF incurred more on variable cost than expected. However, it is necessary to take into consideration the causes of this adverse variance which is beyond the control of the management, for instance, the unusual price hike in vegetables in case of unseasonal rainfall.

(iii) Measures to Improve Fast Food Delivery Service Time

Customers expect that their food order to be delivered quickly. From customer's feedback in the question, it is evident that FF has a problem in food delivery, due to which, customers go unsatisfied. The reason of late delivery could be non-availability of raw material on time or employees not working properly etc. The reason of employees not working properly could be job dissatisfaction which may be due to improper working conditions, low salary, or no reward for overtime etc.

In order to reduce delivery time, raw material should be made available in stock based on daily requirement. FF may follow quantitative approach to inventory problems, which lays down clear guidelines that when to re-order or alert the management in exceptional situations.

In addition, FF must also address the issues related to employee and involve them in a loop. FF could improve the employee satisfaction with proper working conditions, better pay, training, and growth opportunities.

Moreover, it is important that customers should be informed about approximate delivery time since this will reduce customer's anxiety and will proactively reduce any complaints over long waits for delivery of food. If unexpected delays occur, it is important to communicate with customers, apologies for the delay and inform them about the new approximate delivery time along with valid reason.

In addition to this, FF can also introduce pagers or install electronic board displaying ticket number or self-serve kiosk allowing customers to roam around or order in advance so that they do not have long waiting time.

The market size is not within the control of the sales manager and therefore variances caused by changes in the market size would be regarded as planning variances.

However, variances caused by changes in the selling prices and consequently the selling price variances and market shares would be within the control of the sales manager and treated as operating variances.

The market size variance compares the original and revised market sizes. This is unchanged for 3,000 W PMPO Systems so the only variance that occurs relates to the 5,000 W PMPO Systems and is ₹59,37,500 (F) [250 systems × ₹23,750].

It is vital to make this distinction because as can be seen from the scenario the measurement of the 'K's performance is incomplete if the revised market size is ignored.

The favourable volume variance of ₹23,75,000 referred to in the 'K's e-mail is made up of two elements, one of which, the market size, is a planning variance which is outside his control. It is this that has caused the overall volume variance to be favourable, and thus 'K' is not responsible for the overall favourable performance.



It has been stated in the question that "The total market demand for 3,000 W PMPO Systems was as budgeted but as a result of suppliers reducing the price of supporting UHD TV System the total market for 5,000 W PMPO Systems raised by 50% in Jan'2021 . The company had sufficient capacity to meet the revised market demand for 750 units of its 5,000 W PMPO Systems and therefore maintained its market share." Thus, Budgeted Ratio has been taken 2:1 (1,500:750) instead of 3:1 (1,500:500) for computation of "Revised Actual Quantity (RAQ)".

11. The statement reported, ₹2,062 adverse material price variance. The responsibility for controlling the materials price variance is usually the purchasing manager's. Undoubtedly, in current scenario, the price of materials is largely beyond his or her control; however, the price variance can be influenced by such factors as quality, quantity discounts, distance of supplier's location, and so on. These factors are often under the control of the purchase manager. The production manager is responsible for material usage and cannot be held responsible for the material price variance.

Since total usage variance reported, ₹1,406 favourable, production manager could assume good performance. However, if usage variance is considered in more detail, through the mix and yield calculations, it can be observed that variance was driven by a **change in the mix** and by using a mix of ingredients which was different from standard, it has resulted in a saving of ₹840; Similarly, it has led to a favourable yield. It is worthwhile to note that changing the mix could impact the product quality and sales as well, however, no information has been given about this.

Prices and quality of three agriculture ingredients are changing significantly every year. Using ex ante prices and usage standards can implicit an outdated view of variances. Failing to separate variances caused by uncontrollable factors and planning errors from variances caused by controllable factors can be demoralizing for the managers.

In addition, managers are not involved in setting the standard mix and the same has not been changed for six years despite continuous changes in the quality and prices of the ingredients. This can also mislead the managers i.e. to carryout control activities which are based on the outdated standards.

Furthermore, a true image is missing in relation to managers' performance as statement does not include any feedback or comments on the variances. Even no follow up is being taken on the same.

Overall, it appears that AF is not having comprehensive performance measurement system and this could adversely impact the firm in long run.

Workings

Price Variance

Input	Actual Qty. (Kg)	Std. Cost (₹)	Actual Cost (₹)	Difference (₹)	Variance (₹)
B ₁	2,202	3	2.8	0.20	440 (F)
B ₂	2,502	6	7	1 (A)	2,502 (A)
B ₃	921	2	2	-	-
	5,625				2,062 (A)

Usage Variance

Input	Standard Qty. (Kg)	Actual Qty. (Kg)	Difference (Kg)	Std. Cost (₹)	Variance (₹)
B ₁	1,934	2,202	268 (A)	3	804 (A)
B ₂	2,855	2,502	353 (F)	6	2,118 (F)
B ₃	967	921	46 (F)	2	92 (F)
	5,756	5,625	131 (F)		1,406 (F)

Mix Variance

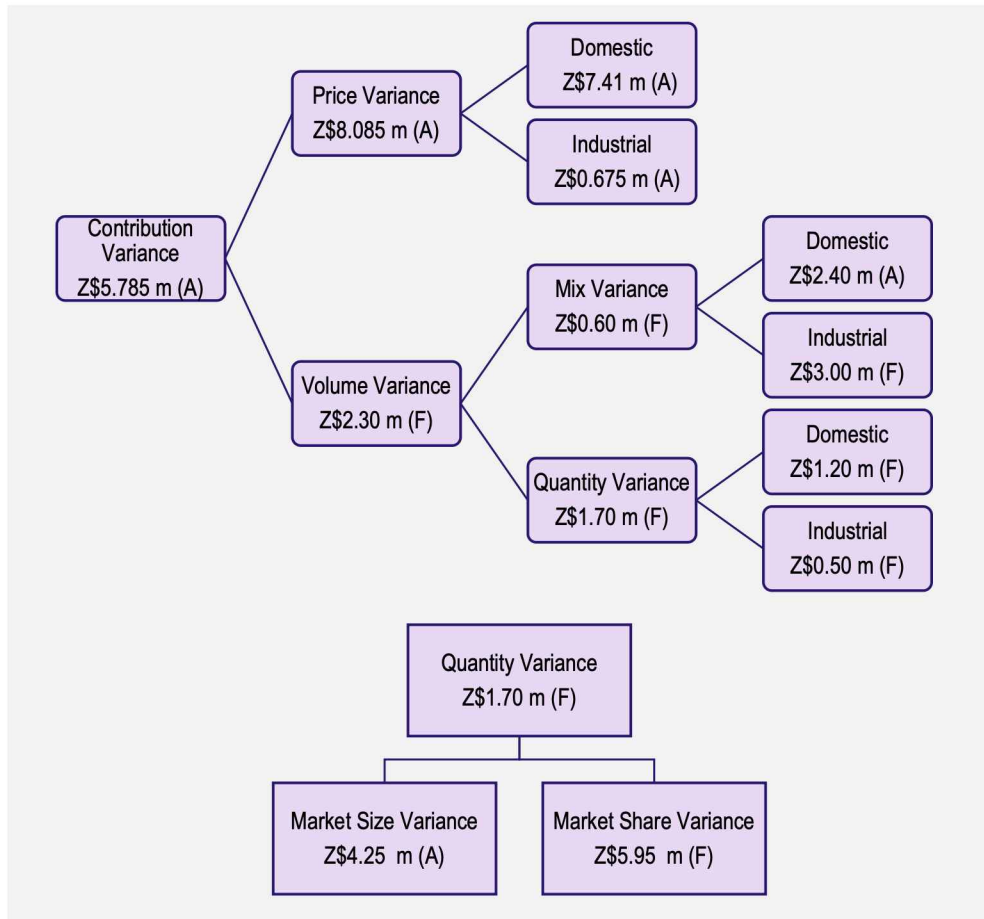
Input	Rev. Actual Qty. (Kg)	Actual Qty. (Kg)	Difference (Kg)	Std. Cost (₹)	Variance (₹)
B ₁	1,890	2,202	312 (A)	3	936 (A)
B ₂	2,790	2,502	288 (F)	6	1,728 (F)
B ₃	945	921	24 (F)	2	48 (F)
	5,625	5,625	NIL		840 (F)

Yield Variance

Input	Standard Qty. (Kg)	Rev. Actual Qty. (Kg)	Difference (Kg)	Std. Cost (₹)	Variance (₹)
B ₁	1,934	1,890	44 (F)	3	132 (F)
B ₂	2,855	2,790	65 (F)	6	390 (F)
B ₃	967	945	22 (F)	2	44 (F)
	5,756	5,625	131 (F)		566 (F)

12. (i) Analysis of Variances

It can be seen that total unit sales increased by 40,000 rolls resulted in a favorable volume variance. Therefore, a potential increase of Z\$2.3 m in contribution margin was achieved as a result of change in sales volume compared with budgeted volume. The volume variance is further divided into a mix and quantity variance. In the case of ZM, mix variance came out to be Z\$0.60 m favorable and the quantity variance came out to be favorable Z\$1.70 m. Favorable mix variance Z\$0.60 m indicates that the sales mix shifts toward the industrial flooring rolls i.e. high contribution product. ZM sold 40,000 more rolls than were budgeted, resulting in Z\$1.70 m favorable quantity variance. Therefore, it is necessary to identify the reasons behind the increase in sales. The reasons may be competitor's distribution issues, better customer services, or growth in overall market. Further insight into reasons of quantity variance can be gained by analyzing market share and size variances. ZM gain 2 market share percentage points from 10% budgeted share to the actual share of 12%. The Z\$5.95 m favorable market share variance may be the effect of the decline in *contribution margin rate*. The impact of changing market size on contribution margin can be traced through market size variance. Market size variance is Z\$4.25 m adverse as actual market size decreased 12.5% compared to budgeted market size. Further, it appears that accountant has missed to compute the *price variance* which is a substantial part of the analysis. If we look closely at the data given, the price variance for domestic as well as industrial roll can be computed without difficulty. The price variance for domestic flooring rolls as well as industrial flooring rolls is unfavorable; this indicates that the both varieties were sold a lower margin than standard. This throughout analysis shows a negative impact of Z\$ 5.785 m on contribution margin for which price variance is the main contributor. Revised structures after the computation of price variance are as under:

**Workings****Contribution Price Variance**

Product	Actual Qty. (units'000)	Actual Contribution per unit (Z\$)	Standard Contribution per unit (Z\$)	Difference (Z\$)	Variance (Z\$)
Domestic	570	27.00	40.00	-13.00	7.41 m (A)
Industrial	270	47.50	50.00	-2.50	0.675 m (A)
Total	840				8.085 m (A)

(ii) Strategic Inputs

The actual sale of industrial flooring rolls is 35% higher than projections. However, actual contribution margin of Z\$47.5 is *marginally lower* than standard contribution margin of Z\$50 per unit. This indicates that ZM may have *cut its selling price to maintain or gain market share*. Therefore, industrial flooring rolls are in the **Growth Phase** of product life cycle. Due to increase in demand, there is a possibility of higher sales and profits to be made in future years.

Similarly, the actual sale of domestic flooring roll is 5% lower than the expectations. However, actual contribution margin is Z\$27 per roll i.e. 32.5% lower than the standard contribution margin. This indicates that ZM may have sold these at *substantially reduced price* to maintain the sales volume. Therefore, the domestic residential flooring rolls might be in the **Decline Stage** of product life cycle.

The market size for flooring rolls has reduced from an expectation of 80 lacs rolls to 70 lacs rolls. Therefore, the market size has shrunk significantly by 12.5% for the year 2021. This is a *threat to profitability* of business. The management has to understand the reasons behind this shrinkage. For example, dwindling demand maybe on account of cheaper substitutes available for flooring rolls. The management has to take cognizance of this threat to business. A positive for ZM is that its actual market share for flooring rolls was higher than expected at 12%. An increase in market share would have a beneficial impact on the company's profitability. Also, despite the shrinkage in market size, demand for industrial flooring rolls seems to be on the rise. This could be an *opportunity* for the management to consider.

As explained above, the industrial flooring rolls seem to be in the Growth Stage of product life cycle, while the domestic residential rolls are in the Decline Stage. Industrial flooring rolls have a higher contribution margin per roll as compared to domestic residential rolls. Accordingly, ZM may consider *phasing out domestic flooring rolls* and *concentrate on industrial flooring rolls*. In view of shrinking market conditions, it would be more profitable to phase out the weaker product and concentrate on the fast moving and profitable product. At the same time, since domestic flooring roll still has *significant demand*, the strategy to phase out this product may have to be done in a *phased and well-planned manner*. In view of the shrinking market size, ZM should not end up losing its market share due to phasing out domestic flooring rolls.

For Your Conceptual Understanding**“Budgeted Vs Actual Figures”**

Product	Budgeted Qty. Rolls ('000)	Standard Cont. per Roll (Z\$)	Budgeted Cont. (Z\$ 'in millions)	Actual Qty. Rolls ('000)	Actual Cont. per Roll (Z\$)	Actual Cont. (Z\$ 'in millions)	Revised Actual Qty. ('000)
Dom.	600	40	24.00	570	27	15.390	630 (840×75%)
Ind.	200	50	10.00	270	47.5	12.825	210 (840×25%)
	800		34.00	840		28.215	840

Contribution Mix Variance

Product	Standard Contribution per unit (Z\$)	Actual Qty. (units'000)	Revised Actual Quantity (units'000)	Difference ('000)	Variance (Z\$)
Domestic	40	570	630	-60	2.40 m (A)
Industrial	50	270	210	+60	3.00 m (F)
Total		840			0.60 m (F)

Contribution Quantity Variance

Product	Standard Contribution per unit (Z\$)	Revised Actual Quantity (units'000)	Budgeted Quantity (units'000)	Difference ('000)	Variance (Z\$)
Domestic	40	630	600	+30	1.20 m (F)
Industrial	50	210	200	+10	0.50 m (F)
Total		840			1.70 m (F)

Market Size Variance

$$\begin{aligned}
 &= \text{Budgeted Market Share \%} \times (\text{Actual Industry Sales Quantity in units} - \text{Budgeted Industry Sales Quantity in units}) \times (\text{Average Budgeted Contribution per unit}) \\
 &= 10\% \times (70,00,000 \text{ Rolls} - 80,00,000 \text{ Rolls}) \times \text{Z\$ } 42.50 \\
 &= \text{Z\$ } 4.25 \text{ m (A)}
 \end{aligned}$$

Market Share Variance

$$\begin{aligned}
 &= (\text{Actual Market Share \%} - \text{Budgeted Market Share \%}) \times (\text{Actual Industry Sales Quantity in units}) \times (\text{Average Budgeted Contribution per unit}) \\
 &= (12\% - 10\%) \times 70,00,000 \text{ Rolls} \times \text{Z\$ } 42.50 \\
 &= \text{Z\$ } 5.95 \text{ m (F)}
 \end{aligned}$$

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