THE INSTITUTE OF CHARTERED ACCOUNTANTS OF NIGERIA
PERFORMANCE MANAGEMENT
Time Allowed 3¼ hours (including 15 minutes reading time)

INSTRUCTION: YOU ARE REQUIRED TO ATTEMPT FIVE OUT OF THE SEVEN QUESTIONS IN THIS PAPER

SECTION A: COMPULSORY QUESTION (30 MARKS)

QUESTION 1

a) Okenze Nigeria Limited, a company based in Aba, produces two grades of moisturising cream. The selling price and associated unit variable costs for the moisturising cream classified as Grade A and Grade B are shown below:

Particulars	Grade A	Grade B
	₦	₦
Selling Price	2,100	1,500
Material x - ₦240 per kg	480	240
Skilled labour - ₦144 per Hour	720	288
Unskilled labour - ₦60 per hour	120	180
Variable overhead - ₦84 per machine hour	168	336

The fixed overhead costs are ₦2,600,000 per month. The company plans to maximise profits.

The availability of resources for the following month is as follows:

Material X	25,000Kg
Skilled labour	48,000 hours
Unskilled labour	39,000 hours
Machine hours	50,000 hours

Required:

i. Identify the objective function and the constraints of the model to be used in determining the optimum production plan for the following month. **(5 Marks)**
ii. Determine the optimum production plan for the month and the associated Profit. **(5 Marks)**
iii. Explain the concept and significance of dual price and slack variable in the context of the model used by the company in this scenario. **(4 Marks)**
iv. Calculate the dual prices for constraints identified in this scenario. **(10 Marks)**

v. Suggest ways in which the management can overcome the capacity constraints identified above during the month and the cost implications. **(6 Marks)**

b. Okenze Nigeria Limited, opened another factory in Enugu to produce a third quality moisturising cream coded Grade C and sales only this grade in this location. The following data has been extracted from the year's budget in respect of Grade C:

Item	Amount
Expected Contribution per unit	₦800
Total weekly fixed costs	₦1,000,000
Weekly Profit	N2,200,000
Contribution to Sales Ratio	40%

The division's production capacity from available information may not be fully utilised in the first year of operation and three possible strategies are under consideration. Each strategy involves reducing the unit selling price on all units sold with a consequential effect on the volume of sales.

The detailed effect of each strategy is as follows:

Strategy	Reduction in unit selling Price	Expected increase in weekly sales volume over budget
	%	%
P	2	10
Q	5	18
R	7	25

The division does not hold inventory of finished goods or raw material.

Required:

Calculate:

i. The selling price per unit of the product C for the current year. **(2 Marks)**

ii. The weekly sales in units and value for the current year. **(3 Marks)**

iii. The current year's break-even point in units and value. **(4 Marks)**

iv. Determine, with a statement, which one of the three strategies should be

adopted by the company to maximise its weekly profits. **(6 Marks)**

c. Compute the company's maximum annual net profit showing Profit made by the three products. **(3 marks)**

(Total 30 Marks)

SECTION B: OPEN-ENDED QUESTIONS

INSTRUCTION: YOU ARE REQUIRED TO ATTEMPT ANY TWO OUT OF THE THREE QUESTIONS IN THIS SECTION (40 MARKS)

QUESTION 2

(a) Okowa International Park (OIP) is a theme park and has for many years been a successful business, which has traded profitably. About three years ago the directors decided to capitalise on their success and reduced the expenditure made on new thrill rides, reduced routine maintenance where possible (deciding instead to repair equipment when it broke down) and made a commitment to regularly increase admission prices. Once an admission price is paid, customers can use any of the facilities and rides for free.

These steps increased profits considerably, enabling good dividends to be paid to the shareholders and bonuses to the directors. The last two years of financial results are shown below.

	2023	2024
	₦	₦
Sales	5,250,000	5,320,000
Less expenses:		
Wages	2,500,000	2,200,000
Maintenance – routine	80,000	70,000
Repairs	260,000	320,000
Directors' salaries	150,000	160,000
Directors' bonuses	15,000	18,000
Other costs (including depreciation)	1,200,000	1,180,000
Net profit	1,045,000	1,372,000
Book value of assets at start of year	13,000,000	12,000,000
Dividend paid	500,000	650,000
Number of visitors	150,000	140,000

TIP operates in a country where the average rate of inflation is around 1% per annum.

Required:

Assess the financial performance of OIP using the information given above. **(14 marks)**

(b) During the early part of 2023 OIP employed a newly qualified management accountant. He quickly became concerned about the potential performance of OIP and to investigate his concerns, he started to gather data to measure some non-financial measures of success. The data he gathered is shown below:

Table 1

	2023	2024
Hours lost due to breakdown of rides (see note 1)	9,000 hours	32,000 hours
Average waiting time per ride	20 minutes	30 minutes

Note: OIP has 50 rides of different types. It is open 360 days of the year for 10 hours each day

Required:

Assess the QUALITY of the service which OIP provides to its customers using Table 1 and any other relevant data and indicate the RISKS it is likely to face if it continues with its current policies. **(6 marks)**

(Total 20 marks)

QUESTION 3

Simple Ifeoma Soup Limited manufactures and sells soups in a JIT environment. Soup is made in a manufacturing process by mixing liquidised vegetables, melted butter and stock (stock in this context is a liquid used in making soups). It operates a standard costing system to control its manufacturing processes. At the beginning of the current financial year, it employed a new production manager to oversee the manufacturing process and to work alongside the purchasing manager. The production manager will be rewarded by a salary and a bonus based on the directly attributable variances involved in the manufacturing process.

After three months of work there is doubt about the performance of the new production manager. On the one hand, the cost variances look favourable, but the sales director has indicated that sales are significantly down and that the overall profitability is decreasing.

The table 1 below shows the variance analysis results for the first three months of the manager's work.

F = Favourable. A = Adverse

	Month 1	Month 2	Month 3
Material Price Variance	₦300 (F)	₦900 (A)	₦2,200 (A)
Material Mix Variance	₦1,800 (F)	₦2,253 (F)	₦2,800 (F)

Material Yield Variance	₦2,126 (F)	₦5,844 (F)	₦9,752 (F)
Total Variance	₦4,226 (F)	₦7,197(F)	₦10,352 (F)

The actual level of activity was broadly the same in each month and the standard monthly material total cost was approximately ₦145,000.

The standard cost card for the period under review is as follows:

	₦
0.90 litres of liquidised vegetables @ ₦0.80/ltr	0.72
0.05 litres of melted butter @ ₦4/ltr	0.20
1.10 litres of stock @ ₦0.50/ltr	0.55
Total cost to produce 1 litre of soup	1.47

Required:

(a) Using the information in table 1:

i. Explain the meaning of each type of variances above (price, mix and yield But excluding the total variance) and briefly discuss to what extent each type of variance is controllable by the production manager. **(6 marks)**

ii. Evaluate the performance of the production manager considering both the cost variance results above and the sales director's comments. **(4 marks)**

iii. Outline two suggestions how the performance management system might be changed to better reflect the performance of the production manager. **(3 marks)**

(b) The board has asked that the variances be calculated for Month 4. In Month 4 the production department data is as follows:

Actual results for Month 4

Liquidised vegetables: Bought 82,000 litres costing	₦69,700
Melted butter: Bought 4,900 litres costing	₦21,070
Stock: Bought 122,000 litres costing	₦58,560

Actual production was 112,000 litres of soup

Required:

Calculate the material price, mix and yield variances for Month 4. You are not required

to comment on the performance that the calculations imply. Round variances to the nearest whole number. **(7marks)**

(Total 20 marks)

QUESTION 4

Ogechi Ventures Ltd has two operating divisions, X and Y, which are treated as profit centres for the purpose of performance reporting.

Division X makes two products, Product A and Product B. Product A is sold to external customers for ₦248 per unit. Product B is a part-finished item that is sold only to Division Y.

Division Y can obtain the part-finished item from either Division X or from an external supplier. The external supplier charges a price of ₦220 per unit.

Department Y produces Product C which is sold at a mark up of 25% of cost which is the company sales policy.

The production capacity of Division X is measured in total units of output, Products A and B. Each unit requires the same direct labour time. The costs of production in Division X are as follows:

Cost Element	Product A	Product B
	₦	₦
Variable cost	184	192
Fixed cost	76	76
Total unit cost	260	268

Required:

a. i. What is an optimal transfer price or price range for Product B? **(3 Marks)**

ii. What would be the optimal transfer price for Product B if there is spare production capacity in Division X? **(3 Marks)**

iii. What would be the optimal transfer price for Product B if Division X is operating at full capacity due to a limited availability of direct labour and there is unsatisfied external demand for Product A? **(5 Marks)**

b. The following additional information relate to business activities in the two divisions.

Particular	Dept. X	Dept. Y
Product A: Production / Sales units	150,000	
Product B: Production of part finished items		100,000
Product B: Procurement from external suppliers		80,000

Product C: Sales		180,000
Investment Capital	₦40 million	₦50 million
Cost of Capital	15%	15%

Required:

i. Prepare an operating statement showing the optimal profit the Divisions can generate in the period when operating at full capacity with no spare capacity. **(4 Marks)**

ii. Using the return on investment and residual income approaches Provide a comparative analysis of the performance of the divisions provided for the period. **(5 Marks)**

(Total 20 Marks)

SECTION C: OPEN-ENDED QUESTIONS .

INSTRUCTION: YOU ARE REQUIRED TO ATTEMPT ANY TWO OUT OF THE THREE QUESTIONS IN THIS SECTION (30 MARKS)

QUESTION 5

Kahkiri Limited manufactures two products, product X and product Y, on the same machines. Sales demand for the products exceed the machine capacity of the company's production department. The potential sales demand in each period is for 16,000 units of Product X and 24,000 units of Product Y. Sales prices cannot be increased due to competition from other firms in the market.

The maximum machine capacity in the production department is 64,000 hours in each period.

The following cost and profitability estimates have been prepared:

	Product X	Product Y
	₦	₦
Sales price	44	54
Direct materials	20	18
Direct Labour	6	11
Variable overhead	6	11
Contribution per unit	12	14
Attributable fixed cost	₦10,000	₦10,000
Machine hours per unit	1.5 hours	2 hours

Fixed costs in each period are ₦100,000

Required:

a. Using a marginal costing approach, calculate the profit-maximising output for the period, and the associated profit for each product and

company. **(4 Marks)**

b. Calculate the throughput accounting ratio for Product X and for Product Y. **(8 Marks)**

c. Using throughput accounting principles, calculate the profit-maximising output in each period, and calculate the amount of the profit**.** **(3 Marks)**

(Total 15 Marks)

QUESTION 6

Chair Co has several new products in development. Information relating to three of these products is as follows:

Luxury car seat

The estimated labour time for the first unit is 12 hours but a learning curve of 75% is expected to apply for the first eight units produced. The cost of labour is ₦15 per hour.

The cost of materials and other variable overheads is expected to total ₦230 per unit. Chair Co plans on pricing the seat by adding a 50% mark-up to the total variable cost per seat, with the labour cost being based on the incremental time taken to produce the 8th unit.

High chair

Another product which chair Co has in development is a new design of high chair for feeding young children. Based on previous experience of producing similar products, Chair Co had assumed that a learning rate of 85% would apply to the manufacture of this new design but after the first phase of production had been completed, management realised that a learning rate of 80% had been achieved.

Office chair

Chair Co has also developed a new type of office chair and management is trying to formulate a budget for this product.

They have decided to match the production level to demand, however, demand for this chair is uncertain.

Management have collected the following information:

	Demand (units)	Probability
Worst possible outcome	10,000	0·3
Most likely outcome	22,000	0·5
Best possible outcome	35,000	0·2

The selling price per unit is ₦25. The variable cost per unit is ₦8 for any production level up to 25,000 units. If the production level is higher than 25,000 units, then the variable cost per unit will decrease by 10% and this reduction will apply to all the units produced at that level.

Total fixed costs are estimated to be ₦75,000.

Chair Co uses cost-plus pricing when setting prices for its products.

You are required to:

a. Determine the labour cost of the 8th unit of the luxury car seat. **(3 marks)**
b. If the first phase of production has now been completed for the new car seat. The first unit took 12·5 hours to make and the total time for the first eight units was 34·3 hours, at which point the learning effect came to an end and Chair Co are planning on adjusting the price to reflect the actual time it took to complete the 8th unit. What was the actual rate of learning that occurred? **(5 marks)**
c. In the redesign of the highchair, state 2 factors responsible for the decrease in learning rate? **(2 marks)**
d. Using probabilistic budgeting, what is the expected budgeted contribution of the office chairs? **(3 marks)**
e. State 2 conditions for the application of learning curve principle. **(2 marks)**

(15 marks)

QUESTION 7

Okechukwu Nig. Ltd. manufactures three products: A, B and C. The monthly production output and sales of the products are as follows:

Product A: 1 020 units,

Product B: 2 000 units,

Product C: 1 600 units.

The company traditionally uses direct machine hours as the basis for applying all

manufacturing overhead costs to the products. The total estimated overhead costs for the next month amount to ₦502,400.

The management is now considering switching to an activity-based costing system in order to calculate the most accurate unit product costs for the purpose of improving the internal management decision making process. The new activity-based costing system would have four overhead activity cost pools: receiving orders, machine maintaining, processing and quality control.

The appropriate data concerning the estimated overhead costs and predicted activity levels is given below:

Activities	Estimated overhead costs (₦)	Activity Driver	Activity Level		
			A	B	C
Receiving orders	32,000	No. of orders	40	68	52
Machine maintenance	288,000	Machine hours	3,400	22,200	6,400
Processing	153,000	Labour hours	6,400	16,400	11,200
Quality control	29,400	No. of inspection hours	260	300	280

Required:

a) Calculate the predetermined overhead rate under the traditional costing system. **(2 marks)**

b) Calculate the overhead cost per unit of each product under the traditional costing system. **(2 marks)**

c) Discuss the limitations of volume-based approach to cost assignment **(3 marks)**

d) Calculate the predetermined overhead rates for all activities under the activity-based costing system. **(2 marks)**

e) Calculate each activity's overhead cost per unit of every product under the activity-based costing system. **(2 marks)**

f) Calculate the overhead cost of each product both in total and per unit under the activity- based costing system. **(2 marks)**

g) Briefly state the impact of ABC costing systems on performance. **(2 marks)**

(Total 15 Marks)

Formulae

Learning curve

$Y = ax^b$

Where Y = cumulative average time per unit to produce x units a = the time taken for the first unit of output

x = the cumulative number of units produced b = the index of learning (log LR/log2)

LR = the learning rate as a decimal

Demand curve

$P = a - bQ$

$$b = \frac{\text{change in price}}{\text{change in quantity}}$$

a = price when Q = 0

MR = a – 2bQ

The linear regression equation of Y on X is given by:

$$Y = a + bX$$

where

$$b = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

$$a = \frac{\sum y}{n} - \frac{b\sum x}{n}$$

Coefficient of determination (r^2)

$$r^2 = \frac{(n\sum XY - \sum x \sum Y1)^2}{(n\sum X^2 - (\sum X)^2 (n\sum y^2 - (\sum X)^2}$$

SUGGESTED SOLUTIONS

SOLUTION 1

a. Identify the objective function and the constraints of the model (linear programming model)

	Contribution per unit	
	A	B
Selling Price	₦2,100	₦1,500
Less Variable costs:		
Material X	480	240
Labour 1-Skilled	720	288
Labour 2-Unskilled	120	180
Variable overhead	168	336
Total variable cost	1,488	1,044
Unit contribution	612	456

Objective function = C = 612a + 456b

Constraints:

Material will be $2a + b \leq 25,000$

Skilled labour will be $5a + 2b \leq 48,000$

Unskilled labour will be $2a + 3b \leq 39,000$

Machine hours will be $2a + 4b \leq 50,000$

Non negativity $a, b \geq 0$

b. In order to determine the optimum production plan, it will be proper to determine graphically the binding equations using the following constraint equation output to determine lines where a and b cross the axes:

Material: 2a + b = 25000 Which is a = 12,500 b = 0; a = 0 b =25,000

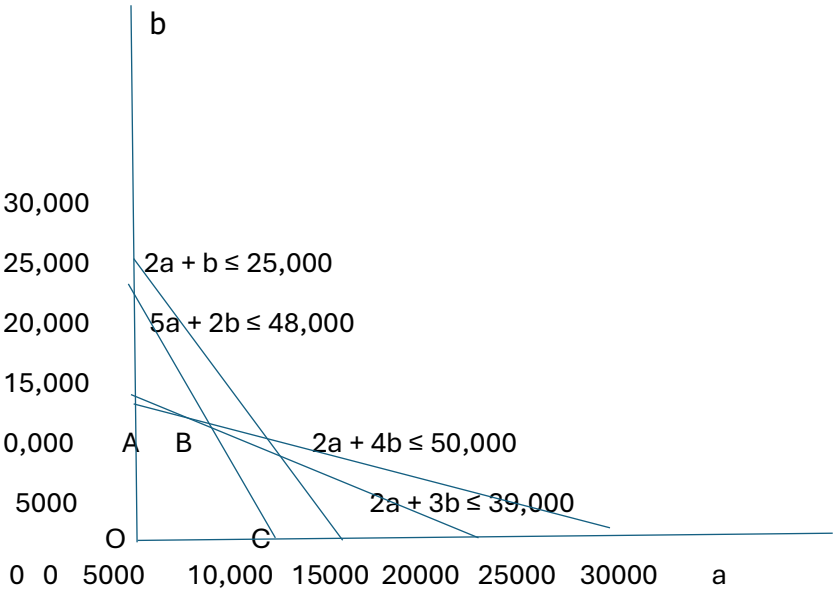
Skilled labour: 5a + 2b = 48000 Which is a = 9600 b = o; a = 0 b = 24,000

Unskilled labour: 2a + 3b = 39000 which is a = 19500 b = 0; a = 0 b =13,000

Machine hours: 2a + 4b = 50000 which is a = 25000 b = 0; a = 0 b =12,500

Highest value for a =25,000

Highest value for b =25,000



The two equations that are binding are Skilled labour (5a +2b = 48,000) and Unskilled Labour (2a + 3b = 39,000)

The binding constraints are skilled and unskilled labour.

From the Graph, the non-limiting factors are material and machine hours while

the limiting factors are skilled labour and unskilled labour hence regarded as binding equations.

Determine the optimum production plan for the month and associated Profit

Hence the equations from the linear programme are:

Skilled labour = 5a + 2b = 48,000 …… ….. Equation 1

Unskilled labour = 2a + 3b = 39,000 ……..... Equation 2

Multiply equation 1 by 3 = 15a + 6b =144,000 …..... Equation 3

Multiply equation 2 by 2 = 4a + 6b = 78,000 ……Equation 4

Subtract equation 4 from equation 3

11a = 66,000

a = 6000

Substitute for a in Equation 1

5a + 2b = 48000

5 (6000) + 2b = 48000

30000 + 2b = 48,000

2b = 48000 - 30000

= 18000

b = 9000

Maximum contribution = 612a + 456b

= 612 x 6000 + 456 x 9000 = (3,672,000 + 4,104.000)

= ₦7,776,000

Less Fixed cost ₦2,600,000

Net Profit ₦5,176,000

c. Concept of dual prices and slack variables

The concept or model used in this situation of dual or double limiting factor decision tool is linear programming approach and it provides instrument for computing optimum solutions when dual constraints are identified. In this case, some constraints are not limited while some are limiting. Skilled and unskilled labour hours are the relevant constraints. The dual prices are also known as shadow prices. The shadow or dual price of a constraint is the change in the objective function that is brought about if such constraint is changed by one unit.

Slack variables on the other hand refer to the amount of the available resources not used in the optimal solution. Only non-limiting resources have slack variables. Limiting resources are fully utilised and therefore do not have slack values. In this case, the slack variables can be determined from material and machine hour resources.

d. Calculate the dual prices for constraints identified in this scenario

Dual price for Skilled Labour

Skilled Labour = 5a + 2b = 48,001 ……..Equation 1

Unskilled Labour = 2a + 3b = 39,000 ……..…Equation 2

Multiply Equation 1 by 3 = 15a + 6b =144,003 ……..Equation 3

Multiply Equation 2 by 2 = 4a + 6b = 78,000 ……..Equation 4

Subtract Equation 4 from Equation 3

11a = 66,003

a = 6000.2727

Substitute for a in equation 1

2a + 3b = 39,000

2(6,000.2727) + 3b = 39,000

12,000.545 + 3b = 39,000

3b = 39,000 – 12,000.545 = 26,999.4545

b = 8,999.82

New Max. contribution

= 612a + 456b = 612 x 6,000.2727 + 456 x 8,999.82 = ₦7,775,918.14

Old contribution = ₦7,776,000.00

Dual price for skilled labour = ₦81.86

Dual price for unskilled labour

Skilled Labour = 5a + 2b = 48,000 ……...Equation 1

Unskilled Labour = 2a + 3b = 39,001 …..…….….Equation 2

Multiply Equation 1 by 3 = 15a + 6b = 144,000 ……... Equation 3

Multiply Equation 2 by 2 = 4a + 6b = 78,002 …….. Equation 4

Subtract Equation 4 from Equation 3

11a = 65,998

a = 5,999.82

Substitute for a in equation 1

5a + 2b = 48,000

5(5,999.82) + 2b = 48,000

29,999.10 + 2b = 48,000

2b = 48,000 – 29,999.10 = 18,000.90

b = 9,000.45

New maximum contribution

= 612a + 456b = 612 x 5,999.82 + 456 x 9,000.45= ₦7,776,095.04

Old contribution = ₦7,776,000.00

Dual price for unskilled labour = ₦95.04

c. Ways linear programming model can be used to overcome capacity constraints:

i. Investigate alternative sources of materials, skilled labour and unskilled labour. Such sources may necessitate overtime hours and bonuses;

ii. Increase operating hours of machinery. Including maintenance cost or purchase cost;
iii. Increase output per hour of machines, which could lead to additional labour cost;
iv. Acquisition of machines requiring purchase and capital costs (Investment or capital outlay); and
v. Subcontract some of the production to outsiders at higher purchase price which could be higher than the incremental costs.

d. Okenze opened a factory in Enugu to produce quality moisturising cream C

Decision making and system implementation

a. i. Selling Price per unit = Contribution divided by C/S ratio = ₦800/0.4 = ₦2,000

ii. Weekly sales in Value and units = weekly contribution divided by C/S ratio Weekly contribution = Weekly profit + weekly Fixed costs. = ₦2,200,000 + ₦1,000,000

= ₦3,200,000

Weekly sales In value = ₦3,200,000/0.4 = ₦8,000,000

Weekly sales in units = ₦8,000,000 / N2,000 = 4,000 units.

iii. Current year"s BEP in value = Fixed cost divided by C/S ratio x 52 weeks

= ₦1,000,000/0.4 = ₦2,500,000 x 52

= (₦2,500,000 x 52wks = ₦130,000,000)

BEP in units = ₦2,500,000 /unit selling price = ₦2,500,000/₦2000 = 1,250 units

= (1,250 units x 52 wks = 65,000 units)

iv. Statement showing the contribution under the three options

Budgeted Selling price ₦2,000

Budgeted Contribution ₦800

Variable costs ₦1,200

Particulars	Strategy P	Strategy Q	Strategy R
Budgeted selling price	₦2000	₦2000	₦2000
Budgeted Volume of sales	4,000	4,000	4,000
	₦	₦	₦
New selling Price	₦2000 x .98= ₦1960	₦2000 x .95=N 1900	₦2000 x .93=₦1860
New Sales Volume	4,000 x 1.1=4400	4,000 x 1.18=4,720	4,000 x 1.25 = 5,000
Sales	8,624,000	8,968,000	9,300,000
Less variable costs	5,280,000	5,664,000	6,000,000
Contribution	3,344,000	3,304,000	3,300,000

Fixed costs	1,000,000	1,000,000	1,000,000
Net Profit	2,344,000	2,304,000	2,300,000

Strategy A gives the highest contribution of ₦3,344,000 and net profit of ₦2,344,000 and should be adopted.

Workings

Selling price under current situation = ₦2000

Less Unit contribution = ₦800

Unit Variable costs = ₦1200

d. Company's Maximum Profit

Particulars	Product A	Product B	Product C	Company (₦)
Sales in units	6,000	9,000	4,400	
Contribution/unit	N612	N456	N760	
Total contribution	3,672,000	4,104,000	3,344,000	11,120,000
Fixed Costs				3,600,000
Net Profit				7,520,000

SOLUTION 2

(a) OIP's financial performance can be assessed in a number of ways:

Sales growth

Sales are up about 1·3% (W1), which is a little above the rate of inflation and therefore a move in the right direction. However, with average admission prices jumping by about 8·6% (W2) and the numbers of visitors falling, there are clearly problems. Large increases in admission prices reduce the value proposition for the customer, it is unlikely that the rate of increase is sustainable or even justifiable. Indeed, with volumes falling (down by 6·7% (W6)), it appears that some customers are being put off and price could be one of the reasons.

Maintenance and repairs

There appears to be a continuing drift away from routine maintenance with management preferring to repair equipment as required. This does not appear to be saving any money as the combined cost of maintenance and repair is higher in 20X5 than in 20X4 (possible risks are dealt with in part (b)).

Directors' pay

Absolute salary levels are up 6·7% (W3), well above the modest inflation rate. It appears that the shareholders are happy with the financial performance of the business and are prepared to reward the directors accordingly. Bonus levels are also well up. It may be that the directors have some form of profit related pay scheme and are being rewarded for the improved profit performance. The directors are likely to be very pleased with the increases to pay.

Wages

Wages are down by 12% (W5). This may partly reflect the loss of customers (down by 6·7% (W6)) if it is assumed that at least part of the wages cost is variable. It could also be that the directors are reducing staff levels beyond the fall in the level of customers to enhance short-term profit and personal bonus. Customer service and indeed safety could be compromised here.

Net profit

Net profit is up a huge 31·3% (W7) and most shareholders would be pleased with that. Net profit is a very traditional measure of performance and most would say this was a sign of good performance.

Return on assets

The profitability can be measured relative to the asset base which is being used to generate it. This is sometimes referred to as ROI or return on investment. The return on assets is up considerably to 11·4% from 8% (W8). This is partly due to the significant rise in profit and partly due to the fall in asset value. We are told that OIP has cut back on new development, so the fall in asset value is probably due to depreciation being charged with little being spent during the year on assets. In this regard it is inevitable that return on assets is up but it is more questionable whether this is a good performance. A theme park (and thrill rides in particular) must be updated to keep customers coming back. The directors of TIP are risking the future of the park.

(b) **Assessing the Quality provision for the services**

Reliability of the rides

The hours lost has increased significantly. Equally the percentage of capacity lost due to breakdowns is now approaching 17·8% (W9). This would appear to be a very high number of hours lost. This would surely increase the risk that customers are disappointed being unable to ride. Given the fixed admission price system, this is bound to irritate some customers as they have effectively already paid to ride.

Average queuing time

Queuing will be seen by customers as dead time. They may see some waiting as inevitable and hence acceptable. However, OIP should be careful to maintain waiting times at a minimum. An increase of 10 minutes (or 50%) is likely to be noticeable by customers and is unlikely to enhance the quality of the TIP experience for them. The increase in waiting times is probably due to the high number of hours lost due to the breakdown with customers being forced to queue for a fewer number of ride options.

Safety

The clear reduction in maintenance could easily damage the safety record of the park and is an obvious quality issue.

Risks

If OIP continues with current policies, then they will expose themselves to the following risks:

a. The lack of routine maintenance could easily lead to an accident or injury to a customer. This could lead to compensation being paid or reputational damage.

b. Increased competition. The continuous raising of admission prices increases the likelihood of a new competitor entering the market (although there are significant barriers to entry in this market, e.g. capital cost, land and so on).

c. Loss of customers. The value for money which customers see when coming to OIP is clearly reducing (higher prices, less reliability of rides and longer queues). Regardless of the existence of competition, customers could simply choose not to come, substituting another leisure activity instead.

d. Profit fall. In the end if customers' numbers fall, then so will profit. The shareholders, although well rewarded at the moment, could suffer a loss of dividend. Directors' job security could then be threatened.

Workings:

(W1) Sales growth is ₦5,320,000/₦5,250,000 = 1·01333 or 1·3%.

(W2) Average admission prices were:

20X4: ₦5,250,000/150,000 = ₦35 per person

20X5: ₦5,320,000/140,000 = ₦38 per person

An increase of ₦38/₦35 = 1·0857 or 8·57%.

(W3) Directors' pay up by ₦160,000/₦150,000 = 1·0667 or 6·7%.

(W4) Directors' bonuses levels up from ₦15,000/₦150,000 or 10% to ₦18,000/₦160,000 or 12·5% of turnover. This is an increase of 3/15 or 20%.

(W5) Wages are down by (1 – ₦2,200,000/₦2,500,000) or 12%.

(W6) Loss of customers is (1 – 140,000/150,000) or 6·7%.

(W7) Profits up by ₦1,372,000/₦1,045,000 = 1·3129 or 31·3%.

(W8) Return on assets:

20X4: ₦1,045,000/₦13,000,000 = 1·0803 or 8·03%

20X5: ₦1,372,000/₦12,000,000 = 1·114 or 11·4%

(W9) Capacity of rides in hours is 360 days x 50 rides x 10 hours per day = 180,000.

20X4 lost capacity is 9,000/180,000 = 0·05 or 5%.

20X5 lost capacity is 32,000/180,000 = 0·177 or 17·8%

SOLUTION 3

a. i. Meaning and controllability by production manager

Material price variance:
Material price variance is the difference between the actual cost of materials purchased and the standard or budgeted cost of those materials. It is computed thus:
Material Price Variance = (Actual Price per Unit - Standard Price per Unit) x Actual Quantity.
Material price variance, while calculated based on actual quantities purchased, is primarily controllable by the purchasing department, not the production manager. The purchasing manager is responsible for negotiating prices with suppliers and securing the best deals, directly influencing the actual price paid. While a production manager can indirectly influence price variance through their production scheduling decisions, the purchasing department's role in procurement is the main driver.

Material mix variance:
Material mix variance is a cost variance that arises when the actual proportions of materials used in production differ from the standard proportions specified in the production plan. It measures the impact on material costs due to using a different mix of materials than the standard. The production manager, purchasing manager and the scheduling material are responsible for this variance.

The variance highlights the cost difference when the actual mix of materials deviates from the standard mix because of proportional differences between the actual proportions of materials used and the standard proportions as can be seen below:

Vegetable mix	₦69,700	82,000
Butter	21,070	4,900
Stock	₦ 58,560	122,000

The recipe determines the mix. The recipe is entirely under the control of the production manager.

Material yield variance
Material yield variance measures the difference between the actual output obtained from a given input and the standard yield expected from that input, valued at standard costs. It essentially reflects how efficiently materials are used in production relative to the standard expected yield. The production manager is totally responsible for the yield variance.
The measurement intentions of material yield variance include:

a. Efficiency of material usage
b. Cost implication as to whether savings were made.

c. Components are standard yield (output) and actual yield (Output)

How it's calculated:

a. **Calculate the standard cost of the actual output:** Multiply the actual output by standard cost per unit.
b. **Calculate the standard cost of the standard yield:** Multiply the standard yield by the standard cost per unit.
c. **Calculate the variance:** Subtract the standard cost of the actual output from the standard cost of the standard yield.

Favourable variance (F) occurs when actual output (Yield) is higher than Standard output or yield using the same material.

Unfavourable or Adverse variance (U) occurs when standard output (Yield) is higher than Actual output or yield using the same material.

This shows the productivity of the manufacturing process. If the process produces more soup than expected, then the yield will be good (favourable). At the moment 2.05 litres of input produce 1 litre of soup, if 2.05 litres of input produce more than 1 litre of soup then the yield is favourable. Greater yield than expected can be a result of operational efficiency or a change in mix. The production manager controls the operational process so should be able to control the yield. Poor quality ingredients can damage yield, but the production manager should be in control of quality and reject dubious ingredients. The production manager is also responsible for things like spillage. Higher spillage can also reduce yield.

Production manager's performance Cost Efficiency

The production manager has produced significant favourable cost variances. The total favourable variance has risen from ₦ 4,226 to ₦ 10,352 in the first three months. This last figure represents approximately 7.1% of the standard monthly spend. The prices for materials have been rising but are probably outside the control of the production manager. The rising prices may have put pressure on the production manager to cheapen the mix. The mix has become cheaper. This could be seen as a cost-efficient step. However, Simply Soup must question the quality implications of this (see later). The yield results are the most significant. The manager is getting far more out of the process than is usual. The new mix is clearly far more productive than before. This could easily be seen as an indicator of good performance if the quality is maintained.

a. Quality

The concern is that the production manager has sacrificed quality for lower cost and greater quantity. The sales director has indicated that sales are falling, perhaps an indication that the customers are unhappy with the product when compared to competitor offers. The greater yield and cheaper mix may well have produced a tasteless soup.

b. Overall

Overall, there has to be concern about the production manager's performance. Cost control and efficiency are important but not at the expense of customer satisfaction and quality. We do not have figures for the extent to which sales have been damaged and small reductions may be acceptable.

c. Changes to the performance management system

The performance management system needs to take account of the quality of the soup being produced and the overall impact a decision has on the business. Quality targets need to be agreed with the manager. These are difficult to quantify but not impossible. For example soup consistency (thickness) is measurable. Regular tasting will indicate a fall in quality; tasters could give the soup a mark out of 10 on taste, colour, smell etc. The production manager should not be rewarded for producing lots of cheap soup that cannot be sold. The performance management system should reflect the overall effect that decisions have. If the production manager's actions have reduced sales then sales volume variances should be allocated to the production manager as part of the performance assessment.

Variance calculations

Material Price Variance

Mixed Vegetables: – (69,700/82,000) = (0.85 - 0.80) x 82,000 = ₦4,100 (A)

Butter: – (21,070/4900) = (4.3 - 4) x 4,900 = ₦1,470 (A)

Stock: – (58,560/122,000) = (0.48 - 0.50) x 122,000 = ₦ 2,440 (F)

Material Mix Variance
Computation of Mix Table (82,000 + 4,900 + 122,000) = 208,900

Material type	Standard mix	Actual mix for 3 months	Actual mix in Std. proportion	Standard proportion of actual production for equivalent 3 month
Mixed vegetables	0.9	82,000	(0.9/2.05) × 208,900= 91,712.2	100,800
Butter	0.05	4,900	(0.05/2.05) X 208,900= 5.095.1	5,600
Stock	1.1	122,000	(1.1/2.05) X 208,900 =112,092.7	123,200
	2.05	208,900	208,900	229,600

If 3 months = 2.05 = 208,900
Then 1 month = Actual Production = 112,000

For 3 Months =112,000 x 2.05 = 229,600
Mixed Vegetables: (82,000 – 91,712.2) x 0.80 = ₦7,770 (F)
Butter: (4,900 – 5,095.1) x 4 = ₦780 (F)
Stock: (122,000 – 112,092.7) x 0.50 = ₦4,954 (A)
Total Mix Variance = ₦3,596 (F)
Note: it is only the total mix variance that is a valid variance here Total input volume = (82,000 + 4,900 + 122,000) = 208,900 * Standard mix for mixed vegetables is = ₦91,712.2

Material Yield Variance:
Mixed vegetables = (91712.2 – 100,800) x ₦0.80 = 7,270.24F
Butter = (5095.1 – 5,600) x ₦4 = 2,019.6F
Stock = (112,092.7 – 123,200) x ₦0.50 = 5553.65F
Total material yield variance = ₦14,843.49F

Note: alternate approaches are acceptable.
Material Yield Variance [112,000 – 101,902.4] x 1.47 = ₦14,843(F)
The standard inputs add up to 2.05 units (0.9+0.5+1.1).

This produces 1ltr of soup.
The actual inputs were 208,900 litres and therefore the standard expected output should be 208,900 = 101,902.4 litres 2.05

SOLUTION 4

(a) i. OPTIMAL TRANSFER PRICE OR PRICE RANGE FOR PRODUCT B

Since the only consumer of product B is Division Y, the minimum transfer price should be set at marginal cost less any cost savings due to internal sales.

The variable cost per unit of product B is ₦192, hence the minimum transfer price should be set at ₦192 per unit of B.

The maximum transfer price per unit for B would be the price that the external supplier charges Division Y, which is ₦220.

Hence, the optimal transfer price per unit would lie between a minimum of ₦192, and a maximum of ₦220.

ii. OPTIMAL TRANSFER PRICE FOR PRODUCT B IF THERE IS SPARE CAPACITY

If Division X has spare production capacity, then the units of product B have no opportunity cost and should be transferred to Division Y at variable cost less any cost savings due to internal sales. The transfer price would therefore be N192 per unit.

iii. OPTIMAL TRANSFER PRICE FOR PRODUCT B IF DIVISION X OPERATES AT FULL CAPACITY

If Division X is at full capacity and would forego sales of product A to supply product B to Division Y, then the units of product B would have to be transferred at marginal cost less any cost savings plus the contribution forgone on sales of product A. The contribution per unit of A is ₦64 (i.e. ₦248 – ₦184). Thus, the optimal transfer price would be ₦192 + ₦64 = ₦256.

(b) OPERATING STATEMENT

	Division X	Division Y	Sales
		₦	₦
Sales			
Product A to external parties (150,000 x ₦248)	37,200,000		
Product B to Division (100,000 x ₦256)		25,600,000	
Product C (₦256 x 1.25 x 180,000)	57,600,000	62,800,000	57.600,000
Variable costs Product A (150,000 x ₦184)	27,600,000		
Product B (100,000 x ₦192		19,200,000	46,800,000
Costs 80,000 @ N220	17,600,000		
100,000 @ ₦256		25,600,000	43,200,000
Contribution			16,000,000
Fixed costs			
Product A (150,000 x ₦76)	11,400,000		
Product B (100,000 x N76)		7,600,000	19,000,000
Profit /(Loss)			(3,000,000)
Profit/(Loss)			14,400,000

ii. COMPARATIVE ANALYSIS OF PERFORMANCE

	Division X	Division Y
	₦	₦
Profit /(loss)	(3,000,000)	14,400,000
Investment	40,000,000	50,000,000
	%	%
ROI	-7.5%	28.80%
Cost of capital	15%	15%
	₦	₦
Profit/(loss)	-3,000,000	14,400,000
Charge on capital employed	6,000,000	7,500,000
Residual Income (RI)	(9,000,000)	6,900,000

Due to the transfer price policy of operating at full capacity, Division X is not able to charge a share of its fixed costs to division Y, hence Division X is operating at a loss of ₦3million while Division Y with no fixed overhead cost implication is operating at a Profit of ₦14.4 million.

The ROI for division X is therefore negative of ₦3million for its investors while Division Y generates a 28.80% returns per Naira invested.

Division X generates a residual loss of ₦9million while Division Y generates a residual income of ₦14.40 million. The cost of capital for both Divisions is the same at 15% but Division Y has a higher investment base.

SOLUTION 5

a. Using marginal costing principles to calculate the profit maximising output and profit:

Products	X	Y
Sales volume	16,000 units	24,000 units
	₦	₦
Sales price	44	54
Less variable costs:		
Direct material	20	18
Direct labour	6	11
Variable overheads	6	11
Total variable costs	32	40
Contribution per unit	12	14
Machine hours per product	1.50 hours	2 hours
Contribution per machine hours	₦8	₦7
Ranking	1st	2nd
Hours Required:		
Product X	= 16,000 x 1.50	= 24,000hours
Product Y	= 24,000 x 2	= 48,000 hours
Total hours machine required	= 72,000 hours	
Available hours:	= 64,000 hours	
Production Mix		
Product X = 16,000 units x 1.50 hours	= 24,000 hours	
Product Y = 40,000 /2 = 20,000 units	= 40,000 Hours	

Therefore, profit maximising output = Product X = 16,000 units
Product Y = 20,000 units

Associated Profit

	X	Y	Total
Product	X	Y	Total
Unit contribution	12	14	
Total contribution	₦192,000	₦280,000	472,000
Less Attributable fixed cost	₦(10,000)	₦(10,000)	(20,000)
Less General Fixed costs			(100,000)
Net Profit	₦182,000	₦270,000	352,000

b. The advantages of throughput accounting over marginal costing method in profit maximising decisions include:

i. It helps to identify the factors that limit the organisation from realising its goal.
ii. It helps management to solve organisational crisis and improve business processes to ensure a competitive edge.
iii. It identifies a method which the organisation can use to improve its financial management.

c. Calculation of the throughput accounting ratio for Products X and Y Computing throughput return per bottleneck

	X	Y
Sales volume	16,000 units	24,000 units
Sales Price	₦44	₦54
Less: Throughput costs:		
Direct material	₦20	₦18
Throughput return	₦24	₦36
Machine hours per unit	1.50 hours	2 hours
Throughput returns per machine hours	₦16	₦18
Ranking	2nd	1st

Factory operating cost per bottleneck	X	Y	Total ₦
Units of production	16,000	24,000	
Direct labour	₦96,000	264,000	360,000
Variable overhead	₦96,000	264,000	360,000
Attributable fixed costs	₦10,000	₦10,000	20,000
Other fixed costs			100,000

Total operating costs
Factory operating cost per machine hour (Bottleneck)= N840,000/64,000 = N13.125
Throughput accounting ratio = $\frac{\text{Throughput return per bottleneck}}{\text{Factory cost per bottle neck}}$

Product	X	Y
Throughput returns per machine hours	₦16	₦18
Factory operating cost per machine hour	₦13.125	₦13.125
Throughput Accounting ratio	$\frac{16}{13.125}$	$\frac{18}{13.125}$
	1.22	1.37
Ranking to manufacture	2nd	1st

d.

Product	X	Y	Total
			₦
Total machine hours	16000 hours	48,000 hours	
Machine hours/Unit	1.5 hours	2 hours	
Profit maximising output	10,667 units	24,000 units	
Throughput return/hour	₦16	₦18	
Total Return	₦256,000	₦864,000	
Total operating cost			1,120,000
Total operating returns			840,000
			280,000

SOLUTION 6

a. Learning curve formula = y = ax b
Cumulative average time per unit for 8 units: Y = 12 x 8–·415= 5·0628948 hours.
Therefore, cumulative total time for 8 units = 40·503158 hours.
Cumulative average time per unit for 7 units: Y = 12 x 7–·415= 5·3513771 hours.
Therefore, cumulative total time for 7 units = 37·45964 hours.
Therefore, incremental time for 8th unit = 40·503158 hours – 37·45964 hours = 3·043518 hours.
Total labour cost for 8th unit =3·043518 x ₦15 = ₦45·65277

b. Actual learning rate:

Cumulative seats	Number of Cumulative produced hours	Total cumulative average hours per unit
1	12.5	12.5
2	?	12.5 x r
4	?	12.5 x r^2
8	34.3	12.5 x r^3

Using algebra: 34·3 = 8 x (12·5 x r^3)
4·2875 = (12·5 x r^3)
0·343 = r^3 Therefore $3\sqrt{0.343}$ = 0.70
r = 0·70
Therefore, the learning rate was 70%.

c. An 80% learning rate means that the learning was faster than expected.

Factors which are present for a learning curve to take effect are a highly manual and repetitive process (so staff can become quicker the more they perform the same series of tasks), no stoppages to production (so the learning rate will not be lost whilst staff are idle) and a stable workforce (so the learning process does not have to keep restarting).

If there is high staff turnover, stoppages in production and continual design changes, then the learning rate will not be effective and should be slower.

d. As the variable cost per unit is changing depending on the production level, contribution for each level needs to be calculated and then the probabilities applied to the outcomes.

Demand Units	Contribution (per unit)	Total Contribution	Probability	Expected budgeted contribution (₦)
10,000	17.00	170,000	0.3	51,000
22,000	17.00	374,000	0.5	187,000
35,000	17.80	623,000	0.2	124,600
				362,600

e. Conditions for the application of Learning curve principle:

The learning curve principle applies well when a process is repetitive, labor-intensive, and involves low labor turnover, especially in the early stages of production where learning and improvement are most pronounced, and without prolonged breaks in production.
Thus other conditions for the applicability of learning curve principles include:

i. repetitive tasks;
ii. labour intensive processes;
iii. low labour turnover;
iv. early stages of production;
v. no prolonged breaks;
vi. measurable output and costs and
vii. data availability and accuracy.

SOLUTION 7

(a)

Total estimated overhead cost = ₦ 502,400

Total no. of machine hours	Total	X	Y	Z
Machine hours	32,000	3,400	22,200	6,400

Overhead rate = 502,400/32,000 = ₦15.70

(b)

	X	Y	Z	Total
Machine hours	3400	22,200	6,400	32,000
Overhead(₦)	53,380	348,540	100,480	502,400
Outputs (units)	1,020	2,000	1,600	4,620
Unit cost (₦)	52.333	174.270	62.80	

(c)

ACTIVITIES	Cost of activity (₦)	Cost driver	Activity volume	OH rate (₦)
Materials handling	32,000	no. of tonnes	160	200
Engineering	288,000	machine hours	32,000	9
Processing	153,000	labour hours	34,000	4.50
Packaging	29,400	No of order	840	35
Total	502,400			

(d), (e), (f)

ACTIVITIES	per X	per Y	per Z
Materials handling	8,000	13,600	10,400
Engineering	30,600	199,800	57,600
Processing	28,800	73,800	50,400
Packaging	9,100	10,500	9,800
TOTAL	76,500	297,700	128,200
Cost per unit	75	148.85	80.125

(g)

i. One major limitation of a traditional volume-based costing system is that it tends to under-cost complex low-volume products and over-cost high-volume products
ii. The ABC system presents a more accurate measurement of product costs by tracing overhead consumption