

**SECTION A – 50 MARKS**

**Question One**

**(a) Prepare a revised out-turn performance report for the new product that**

- (i) shows the flexed budgeted direct labour hours and direct labour cost based on the revised learning curve data, and**
- (ii) shows the variances that reconcile the actual results to your flexed budget in a much detail as possible.**

**(7 marks)**

	Flexed budget	Actual	Variance
Output (batches)	50	50	
Direct labour hours	68.91 hours (W1)	93.65 hours	24.74 hours (A)
Direct labour cost (\$)	\$826.92 (W2)	\$1,146	\$319.08 (A)

Direct labour efficiency variance = 24.74 hrs x \$12 per labour hr = \$296.88 (A)

Direct labour rate variance = \$319.08 - \$296.88 = \$22.20 (A)

**Workings**

**(W1) – Direct labour hours**

The learning curve ceases once we reach 30 batches, meaning that labour will not get any faster in the production of any more units. Therefore we need to work out the total time for 30 batches and compare with the total time for 29 batches to obtain the time taken to make the 30<sup>th</sup> batch and use that as the time needed to make any further batches.

Using the learning curve formula:

$$Y = aX^b$$

**Y** = average time for that (X) number of units or the average cost per unit

**a** = time for the first unit or the cost for the first unit

**X** = the number of units you want to calculate an average time or cost for

**b** = the index of learning ( $\log r / \log 2$ )

a = 10 hours, b = -0.5146

Work out the average time for 30 batches:

Y = 10 x (30 to the power of 60.5146) = 1.737 hours

Total time for 30 batches = 1.737 x 30 = 52.11 hours

## P2 May 2010 Exam Solutions

Work out the average time for 29 batches:

$$Y = 10 \times (29 \text{ to the power of } 0.5146) = 1.768 \text{ hours}$$

$$\text{Total time for 29 batches} = 1.768 \times 29 = 52.27 \text{ hours}$$

$$\text{Time for the 30}^{\text{th}} \text{ batch} = 52.11 \text{ hours} - 51.27 \text{ hours} = 0.84 \text{ hours}$$

$$\text{Total time for 50 batches} = 52.11 \text{ hours} + (20 \text{ batches} \times 0.84 \text{ hours}) = 68.91 \text{ hours}$$

### **(W2) – Direct labour cost**

$$68.91 \text{ labour hours} \times \$12 \text{ per labour hour} = \$826.92$$

**(b) Explain why your report is more useful to the production manager than the report shown above. (3 marks)**

- The original budget did not take into account the revised expectations of the learning curve for direct labour and therefore making comparisons is meaningless.
- The original budget was not adjusted or flexed for the actual level of output to obtain a fair basis of what should be expected to be used in terms of resources and costs.
- The revised out-turn performance report analyses the labour cost variance further into the efficiency variance and labour rate variance, thus allowing improved understanding of the real cause of the variance and then being able to assign responsibilities to the appropriate managers.

### **Question Two**

**Explain the changes that are likely to occur in the following items at the three later stages in the product life cycle of a typical PQ product.**

**(i) Selling price**

**(ii) Production costs**

**(iii) Selling and marketing costs**

**(10 marks)**

### (i) Selling price

PQ's product being a consumer electronic product will have been a product that customers are willing to pay a premium for but this will not be sustainable as competitors will eventually enter the market. This will be seen during the growth stage as competition begins to enter the market, PQ will have to reduce its selling price; however PQ will still continue to increase contribution through economies of scale.

During the maturity and decline phase PQ will have to continue to reduce the selling price of their product in order to stay competitive, as closer more competitive substitutes will enter the market produced by other manufactures, these substitutes would have been created by manufactures purchasing PQ's product and reverse engineering the product.

This approach will aim to sustain demand and contribution from PQ's product as long the selling price is greater than the marginal cost of manufacturing the product. The cash flow will be used to develop other products in development.

In the decline phase PQ will further reduce the selling price of the product and it will eventually cease as there will be no extra benefit from this product as the product will have fallen out of favour with customers, and any of the product left will be sold at a vastly discounted selling price to clear it out of PQ's inventory. The new more advanced replacement product will have been fully introduced.

### (ii) Production costs

There will be a continued reduction in unit production costs of this product during its growth stage but unlikely to see any further reductions beyond this stage. This will be attributable to economies of scale being enjoyed by the company through mass production techniques, such as below:

- Learning curve effects enjoyed by the workforce because the production is labour intensive, repetitive and most of the staff is retained over the long term.
- Technical efficiencies learned by all departments in the manufacture of the product, especially the production department through improved understanding of how material and machines can be used more efficiently to maximise production.
- Stock control systems will be more efficient if the company employs a JIT approach to stock management. This will reduce stock holding costs to nil and material is only used or bought if there is a demand.
- Discounts will have been received as the company would buy more and more bigger batches of the raw material throughout the product's life cycle.

## **P2 May 2010 Exam Solutions**

- Total quality management techniques will be used which means that the product will be made to a very high standard reducing internal failure costs such as the inspection and scrap material and also reduction in external failure costs such as repairs and replacement.

During the maturity phase there is unlikely to be any further significant cuts in unit variable costs, and in the decline phase the unit production cost will begin to increase. This is expected as the demand for this product will be reduced significantly as it will have fallen out of favour with customers, and therefore less is being made and as a result fewer materials needed. The lower prices on raw materials cannot be enjoyed because of the reduced quantities bought by the company and hence the increase in unit production costs. In addition production costs will increase due to machine breakdowns and inefficiencies.

### **(iii) Selling and marketing costs**

During the growth stage there will be much reduced expenditure on selling and marketing costs as there will be wide customer awareness of the product already and a minimal amount of expenditure will be required to reinforce the continued customer awareness of the product.

During the maturity stage such costs will be reduced further as the product is being more sold on reputation and word of mouth. Selling and marketing costs are not bringing any further benefit.

During the decline stage selling and marketing costs will cease as the product will fall out of favour with customers and will mainly become obsolete and production of which will also cease.

### **Question Three**

**(a) With the current production system,**

**(i) Calculate for each of the six months and the period in total, the total inventory holding costs.**

**(ii) Calculate the total production cost savings made by changing to a JIT production system.**

**(6 marks)**

## P2 May 2010 Exam Solutions

### (a) (i) (ii)

Month	Demand Std Hrs	Basic Production Std Hrs	Inc/(Dec) Inventory Std Hrs	Closing Inventory Std Hrs	Ave Inventory Std Hrs	Inventory Holding Costs (\$6 per month)	Overtime Costs if using JIT (\$15 per hour) (W1)
1	3,100	3,780	680	680	340	2,040	
2	3,700	3,780	80	760	720	4,320	
3	4,000	3,780	(220)	540	650	3,900	3,437.55
4	3,300	3,780	480	1,020	780	4,680	
5	3,600	3,780	180	1,200	1,110	6,660	18,750
6	4,980	3,780	(1,200)	0	600	<u>3,600</u>	<u>18,750.00</u>
Total						<u>25,200</u>	<u>22,187.55</u>

The total production cost savings are  $\$25,200 - \$22,187.55 = \$3,012.45$ .

### Workings

#### (W1) – Overtime costs

Month 3 =  $220 \text{ std hours} / 0.96 = 229.17 \text{ hours} \times \$15 \text{ per hour} = \$3,437.55$

Month 6 =  $1,200 \text{ std hours} / 0.96 = 1,250 \text{ hours} \times \$15 \text{ per hour} = \$18,750$

#### (b) Explain TWO other factors that should be considered by XY before changing to a JIT production system. (4 marks)

Only 2 factors are needed to be explained from the following:

1. There needs to be close relationships and contractual agreements with the suppliers which would need to be maintained throughout, since no inventory will be kept at XY for urgent requests such sales or defective items.
2. Smaller and more frequent deliveries will need to be planned and co-ordinated to coincide with production needs. The supplier may not have the logistics to support XY.
3. Higher quality machines will be needed with regular maintenance to avoid delays.
4. There will need to be involvement and training of staff to maintain flexibility of working hours and skills.
5. Staff need to take responsibility of their quality and so they need to be encouraged and motivated to do so.

**Question Four**

**(a) Discuss the present budgeting system and its likely effect on divisional partner motivation. (6 marks)**

In the present budgeting system the senior partner estimates demand for the year while the divisional manager creates the cost budgets to support demand. The cost budgets are submitted for review by the senior partner but any amendments to the budgets are included without consultation with the divisional partners. This illustrates that the senior partners do not really allow divisional partners to participate in the budgeting process as they are not consulted on budget revisions.

This can de-motivate staff leading to a decline in their productivity and efficiency as they feel their expert opinions are not important and are simply ignored. The divisional partners would feel that they have wasted their time in creating the budgets and would begin to feel that they are not part of the process to improve the organisation. There is great danger of a divide being created between the senior partner and the divisional partners.

The current approach may also see divisional partners start to find excuses not meeting targets just to prove to the senior partner that their budgets were correct and the changes imposed by the senior partner were wrong. Sub-optimisation or dysfunctional behaviour may occur for example the personal objectives of the divisional partner are not aligned with the business objectives.

**(b) Explain two non-financial performance indicators (other than client satisfaction and service quality) that could be used by the firm. (4 marks)**

Only 2 are needed to be explained from the following:

- Training days per staff ó measures the level of investment that the firm has committed to improving staff skills to support the needs of clients.
- Staff turnover ó measures the number of staff leaving the firm indicating that staff are perhaps dissatisfied with the firms approach to supporting the needs of staff.
- Training costs per staff ó measures the amount of money the firm have set aside for staff training purposes.
- Time taken between client first enquiry and first meeting ó measures efficiency and flexibility of the firm to clients needs.

**Question Five**

**(a) Explain, using examples from the scenario, three issues that LMN should consider when designing a new divisional performance statement. (6 marks)**

Performance within an organisation should be focused on assessing what can be controlled by divisions or individuals and omitting any items which are uncontrollable. However this is clearly not the case here as there are issues the divisional directors are responsible for but are not within their control.

Three issues are as follows:

- The investment decisions that divisional directors are responsible for maybe limited due to the \$100,000 threshold. It is not clear as to the size of the divisions and therefore it cannot be ascertained with certainty if divisional directors can freely make meaningful independent decisions.
- Head office costs are apportioned on an arbitrary basis with no consideration for the activities or costs expended in each of the divisions; furthermore the divisions do not have control over their own efficiency of resources that they use.
- The transfer prices are enforced by head office and the divisional directors have no input into their calculations. It is not clear whether head office is imposing on divisions to transfer internally or whether they can decide themselves to purchase internally or externally. There is also no information on the extent of internal demand for goods and services.

**(b) Discuss the advantages of applying Activity Based Costing to apportion all the Head Office costs. (6 marks)**

Activity based costing (ABC) will look in more detail about what caused the head office costs to be incurred and will seek to work out many cost drivers (activities). A cost driver is any factor that causes a change in the cost activity, so it is important to identify a causal relationship between the cost driver and the cost. So for example there maybe head office costs which do not relate to any activities of the divisions but are administrative expenses to support the organisation as a whole. These should be ignored as they cannot not be affected by decisions undertaken by the divisions. LMN must only look at costs which would occur due to the activities of the divisions, this may mean including other costs and removing others. This would then result in a fairer way to assess the divisions.

## **P2 May 2010 Exam Solutions**

This would allow more efficient management of resources by understanding what drives costs incurred by divisions. There would be better costing information for planning and control for example and how different products, customers or distribution channels consume different resources. Furthermore, more realistic and competitive pricing to cover overheads and better profitability analysis because of improved accuracy over costs.



**SECTION B – 50 MARKS**

**Question Six**

**(a) Assuming that RT completes the order with the commercial customer, prepare calculations to show, from a financial perspective, the optimum production plan for June 2010 and the contribution that would result from adopting this plan. (6 marks)**

In order to find the optimum production plan we must first establish what the scarce resource is that is restricting production to meet all demand. We will work out the total amount of resources needed to meet maximum demand and then compare this to the resources that we have available to us to determine any scarce resources.

	R	T	Total
Total demand	750	1,150	
Direct labour (hours)	2,250	5,750	8,000
Material A (kg)	3,750	4,600	8,350
Material B (kg)	1,500	1,150	2,650
Machine hours	2,250	4,600	6,850

Direct labour hours is the scarce resource or limiting factor as we only have available to us 7,500 hours and we need 8,000 hours.

Product	R \$ per unit	T \$ per unit
Selling price	130	160
Direct labour (\$8 per hour)	(24)	(40)
Material A (\$3 per kg)	(15)	(12)
Material B (\$7 per litre)	(14)	(7)
Machine hours (\$10 per hour)	(30)	(40)
<b>Contribution</b>	<b>47</b>	<b>61</b>

Contribution per labour hour       $47/3 = 15.67$        $61/5 = 12.20$

Rank in order of production                      1                      2

Total labour hours available is 7,500 hrs, however we must fulfil a commercial customer order first of 250 Rø and 350 Tø before working out the optimum production plan.

	Commercial contract	Labour hours per unit	Labour hours used
R	250	3	750
T	350	5	<u>1,750</u>
Total			<u>2,500</u>

## P2 May 2010 Exam Solutions

Amount of labour hours available after commercial contract is 5,000 hrs.

		Labour hrs used
R	500 units x 3 hrs	1,500
T	5,000 hrs ó 1,500 hrs = 3,500 hrs      3,500 hrs / 5 hrs = 700 units	<u>3,500</u>
		<u>5,000</u>

### Optimum production plan

	Commercial contract	Production	Total
R	250	500	750
T	350	700	1,050

### Contribution per unit from commercial contract

Product	R \$ per unit	T \$ per unit
Selling price	100	135
Direct labour (\$8 per hour)	(24)	(40)
Material A (\$3 per kg)	(15)	(12)
Material B (\$7 per litre)	(14)	(7)
Machine hours (\$10 per hour)	(30)	(40)
<b>Contribution</b>	<u><b>17</b></u>	<u><b>36</b></u>

### Contribution from production plan

	Contract	Market	
R	250 x \$17 = \$4,250	500 x \$47 = \$23,500	\$27,750
T	350 x \$36 = \$12,600	700 x \$61 = \$42,700	<u>\$55,300</u>
<b>Contribution</b>			<u><b>\$83,050</b></u>

**(b) Prepare calculations to show, from a financial perspective, whether RT should complete the order from the commercial customer. (3 marks)**

By carrying out the commercial contract it means that we fall short of meeting market demand of T by 100 units. The lost contribution of this is 100 units x \$61 per unit = \$6,100. This is less than the financial penalty of \$10,000 if the commercial contract was not met, so therefore it is better at least from a financial perspective to fulfil the commercial contract.

(c) Assuming that RT completes the order with the commercial customer, and using graphical linear programming, prepare a graph to show the optimum production plan for RT for June 2010 on the basis that the availability of all resources is 10% lower than originally predicted. (11 marks)

	Revised resource availability	Commercial contract	Resources remaining
Labour (hrs)	$7,500 \times 0.9 = 6,750$	2,500	4,250
Material A (kg)	$8,500 \times 0.9 = 7,650$	2,650	5,000
Material B (kg)	$3,000 \times 0.9 = 2,700$	850	1,850
Machine hours	$7,500 \times 0.9 = 6,750$	2,150	4,600

Objective function =  $47R + 61T$

Constraints:

$3R + 5T$	$\leq$	4,250	(Labour)
$5R + 4T$	$\leq$	5,000	(Material A)
$2R + T$	$\leq$	1,850	(Material B)
$3R + 4T$	$\leq$	4,600	(Machine hours)
$R \leq 500, T \leq 800$			(Maximum demand)

**Logic or non-negativity constraints** – these are constraints which will ensure that the answer obtained in the solution is sensible in that only zero or positive values are in the answer.

$R \geq 0, T \geq 0$  (Non-negativity or logic)

All constraints are plotted on to a graph and then moving away from the origin a solution is sought where all constraint conditions are met and maximises the objective function.

(Labour)  $3R + 5T = 4,250$

If  $R = 0$  then:

$$\begin{aligned} 3(0) + 5T &= 4,250 \\ 5T &= 4,250 \\ T &= 4,250 / 5 \\ T &= 850 \end{aligned}$$

If  $T = 0$  then:

$$\begin{aligned} 3R + 5(0) &= 4,250 \\ 3R &= 4,250 \\ R &= 4,250 / 3 \\ R &= 1,417 \end{aligned}$$

## P2 May 2010 Exam Solutions

(Material A)  $5R + 4T = 5,000$

If  $R = 0$  then:

$$5(0) + 4T = 5,000$$

$$4T = 5,000$$

$$T = 5,000 / 4$$

$$T = 1,250$$

If  $T = 0$  then:

$$5R + 4(0) = 5,000$$

$$5R = 5,000$$

$$R = 5,000 / 5$$

$$R = 1,000$$

(Material B)  $2R + T = 1,850$

If  $R = 0$  then:

$$2(0) + T = 1,850$$

$$T = 1,850$$

If  $T = 0$  then:

$$2R + 0 = 1,850$$

$$2R = 1,850$$

$$R = 1,850 / 2$$

$$R = 925$$

(Machine hours)  $3R + 4T = 4,600$

If  $R = 0$  then:

$$3(0) + 4T = 4,600$$

$$4T = 4,600$$

$$T = 4,600 / 4$$

$$T = 1,150$$

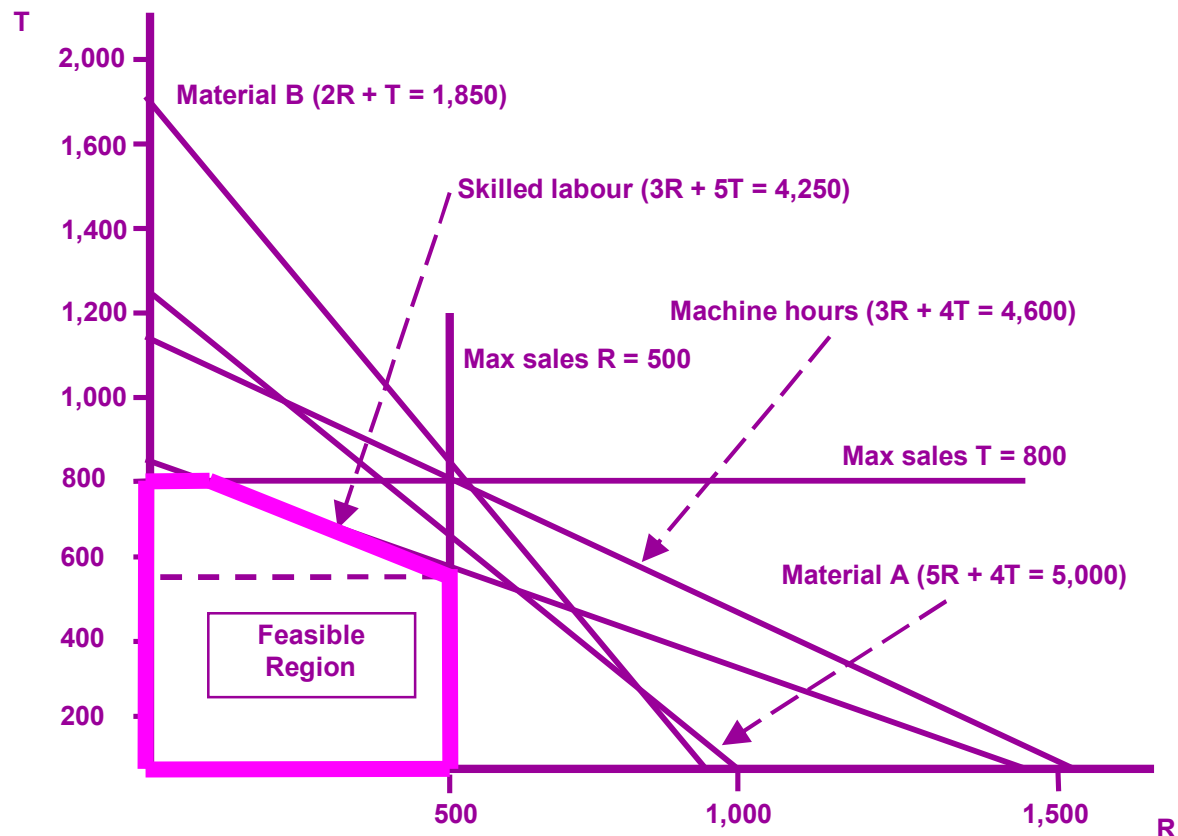
If  $T = 0$  then:

$$3R + 4(0) = 4,600$$

$$3R = 4,600$$

$$R = 4,600 / 3$$

$$R = 1,533$$



The optimal solution is the furthest point away from the origin within the feasible region; therefore the optimal production plan is make 500 units of R and 550 units of T in addition to the contract.

**(d) Discuss how the graph in your solution to (c) above can be used to help to determine the optimum production plan for June 2010 if the actual resource availability lies somewhere between the managers' optimistic and pessimistic predictions. (5 marks)**

If there is an increase in optimism by managers then the constraints would all move to the right illustrating the availability of more resources and production would increase. Currently the most constraining lines are labour hours and maximum demand for R.

If labour hours were increased then there would be further production of T as the labour constraint would move to the right. This would continue up until the labour constraint intersects with the material A constraint and maximum demand for R, it is at this point material A also becomes a constraining resource and would need to be increased if production were to further increase.

Clearly it can be said that in any event labour hours needs to increase if production were to be expanded, other resources if increased would have no immediate effect as there are resources in excess available.

**Question Seven**

**(a)**

**(i) Calculate the annualised Return on Investment (ROI) achieved by each of the process divisions during April 2010. (4 marks)**

**Return on capital employed (ROCE)**

$$= \frac{\text{Profit before interest and tax (PBIT)}}{\text{Capital employed}} \times 100\%$$

ROCE is also referred to as return on investment (ROI) and return on net assets (RONA). ROCE measures profitability and shows how well the business is utilising its capital to generate profits.

Process	Profit & loss \$	Capital employed \$	Monthly ROI %	Annualised ROI %
B	18,800	$800,000 \times 0.8 = 262,144$	$18,800 / 262,144 = 7$	$7 \times 12 = 84$
C	(15,550)	$500,000 \times 0.8 = 320,000$	$(15,550) / 320,000 = (5)$	$(5) \times 12 = (60)$
D	(5,000)	$300,000 \times 0.8 = 32,212$	$(5,000) / 32,212 = (15)$	$(15) \times 12 = (180)$

**(ii) Discuss the suitability of this performance measure in the context of the data provided for each process division. (4 marks)**

Capital equipment bought in each division has been purchased at different points in time compared to other divisions; therefore it means that the ROI comparison between divisions will be inconsistent. This is due to the fact that the price paid will be affected by inflation and in addition depreciable years will be different between divisions.

Some of the costs are not within the control of the divisional managers namely head office costs which are apportioned arbitrarily; therefore it would be unfair to measure performance based on these divisional profits.

Transfer prices are being used between divisions which are a mark up on the total costs of the process. This is unfair as the receiving division has no control over the costs of the supplying division on which the transfer price calculated. The receiving division's performance will be affected by the costs of the supplying division.

Division C and D have fixed costs occurring regardless of the volume received from division B, therefore the managers of C and D have little control over their activity and in addition they are highly geared and so dependent on high levels of activity in order to cover their fixed costs.

**(b)**

**(i) Calculate the effect on the annualised Return on Investment in 2011 of Process Division C investing in new capital equipment. (4 marks)**

**If investment was undertaken:**

Extra income generated 1,500 litres	\$30,000
from abnormal losses at \$20 per litre	
Abnormal sales forgone	(\$750)
1,500 litres x \$0.50	
Increase in depreciation (W1)	(\$11,333)
\$16,666 - \$5,333	
Loss in 2010	<u>(\$15,550)</u>
Profit	<u>\$2,367</u>

$$\text{ROI} = (\$2,367 / \$1,000,000) \times 100\% = 0.24\%$$

$$\text{Annualised ROI} = 0.24\% \times 12 = 2.88\%$$

**If investment was not undertaken:**

Fall in depreciation (W1)	\$1,066
\$5,333 - \$4,267	
Loss in 2010	<u>(\$15,550)</u>
Loss	<u>(\$14,484)</u>

$$\text{ROI} = [(\$14,484) / \$256,000] \times 100\% = (5.66\%)$$

$$\text{Annualised ROI} = (5.66\%) \times 12 = (67.89\%)$$

**Workings**

**(W1) – Depreciation**

Year	NBV b/f	Depreciation (20% reducing balance)	NBV c/f
	\$		\$
2008	500,000	100,000	400,000
2009	400,000	80,000	320,000
2010	320,000	64,000	256,000
2011	256,000	51,200	

Monthly depreciation charge on old machine in 2010

$$= \$64,000 / 12 = \$5,333$$

Monthly depreciation charge on old machine in 2011

$$= \$51,200 / 12 = \$4,267$$

Monthly depreciation charge on new machine in 2011

$$= (\$1,000,000 \times 0.2) / 12 = \$16,666$$

**(ii) Discuss the conflict that may arise between the use of NPV and ROI in this investment decision. (4 marks)**

This investment decision shows a small increase in ROI of 2.88% per annum and should be accepted if the increase is adequate. There may be objections from division C as the manager may feel that this is not enough and there is a good chance it may cause a fall in ROI if the figures used are not accurate. The choice should be based on using NPV based on the company's cost of capital. If it is positive then the investment should be accepted.

Using ROI the profits can be manipulated because it includes some non-cash based items such as depreciation. For example the depreciation rate could be decreased to increase the profit and thereby increasing the ROI. NPV uses relevant costing and so only includes those cash flows that will change as a result of the investment decision and so there is less scope for manipulation.

ROI ignores the time value of money as future cash flows are worth less today and that they should be discounted to reflect this. NPV takes account of the time value of money as it applies discounting to future cash flows to give them same real value if they were received today.

**(c) Discuss the transfer pricing policy being used by H from the viewpoints of the managers of Process Division B and Process Division D. (9 marks)**

**Manager of division B**

The manager of B would be in favour of the current transfer pricing policy as all of his output is transferred to C or D and furthermore a by-product is created (due to this process) which is sold externally. All of his costs are covered and receives a profit through the transfer price which is budgeted cost plus 15% mark up. The problem with this is that there is no incentive for manager B to control any inefficiencies in his process as he knows that all costs will be paid by the transfer pricing policy, furthermore, if there are any efficiencies made he will be rewarded for it.

**Manager of division D**

The manager of D can buy the material D externally for \$7.50 per litre or pay \$9.20 per litre internally from B. It is easy to see that the manager of D is going to purchase externally as it is cheaper than buying from B, and so the manager of D is not in favour of the current transfer pricing policy.



### Group perspective

It is important that divisions transfer material between them as far as possible otherwise there may be materials that the group make which are not used internally but instead the same items are being bought externally at a high cost, leading extra unnecessary costs. Clearly the manager of D needs to be encouraged not to make the sub-optimal decision of purchasing material externally when it is being made by division B. Furthermore, the material D being produced by B is part of a joint process and so in any event will be made and so if it is not transferred to division D then it will be wasted. There would be no change to the costs of process B and external costs spent by the group will rise.

The transfer price between division B and division D should at least match the market price of \$7.50 and so division D would be encouraged to accept the transfers from division B. One way to do this is perhaps by reducing the costs being apportioned to the manufacture of material B and so therefore division B can charge a lower price to division D.

A dual pricing approach can be adopted to help in this situation, as this would mean we give the transfer price to each of the divisions that would want in order to agree to transfer. For example we allow division B to transfer at \$9.50 but give a transfer price of \$7.50 to division D. This would encourage the transfer and the difference in the prices can be resolved through head office re-apportioning it as charges to all divisions.