

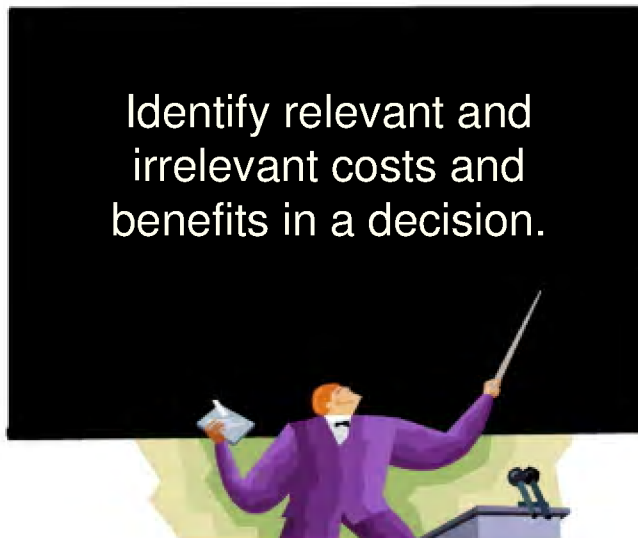
Differential Analysis: The Key to Decision Making

Chapter 14

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Learning Objective 1

Identify relevant and irrelevant costs and benefits in a decision.



Cost Concepts for Decision Making

A **relevant cost** is a cost that differs between alternatives.



Identifying Relevant Costs

An **avoidable cost** is a cost that can be eliminated, in whole or in part, by choosing one alternative over another. Avoidable costs are relevant costs. Unavoidable costs are irrelevant costs.

Two broad categories of costs are never relevant in any decision. They include:

- **Sunk costs.**
- **Future costs that do not differ** between the alternatives.

ONLY FOR
THE
ANALYSIS,
STILL A
TRUE
EXPENSE

real
life
many
similar
example

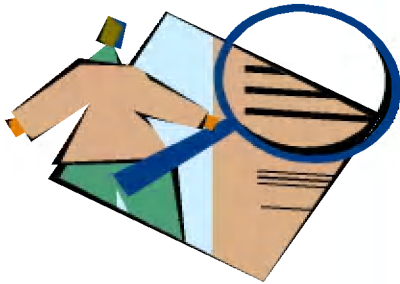
Relevant Cost Analysis: A Two-Step Process

Step 1 Eliminate costs and benefits that do not differ between alternatives.

Step 2 Use the remaining costs and benefits that differ between alternatives in making the decision. The costs that remain are the differential, or avoidable, costs.



Different Costs for Different Purposes



Costs that are relevant in one decision situation may not be relevant in another context. Thus, in each decision situation, the manager must examine the data at hand and isolate the relevant costs.

Identifying Relevant Costs

Cynthia, a Malaysian student studying in Penang, is considering visiting her friend in Kuala Lumpur. She can drive or take the budget airline. By car, it is 230 miles to her friend's apartment. She is trying to decide which alternative is less expensive and has gathered the following information:

	Annual Cost of Fixed Items	Cost per Mile
1 Annual straight-line depreciation on car	\$ 2,000	0.200
2 Cost of gasoline		0.100
3 Annual cost of auto insurance and license	1,360	0.138
4 Maintenance and repairs		0.065
5 Parking fees at school	360	0.036
6 Total average cost		\$ 0.619

\$45 per month × 8 months

\$2.70 per gallon ÷ 27 MPG

\$24,000 cost – \$10,000 salvage value ÷ 5 years

Identifying Relevant Costs

Automobile Costs (based on 10,000 miles driven per year)		
	Annual Cost of Fixed Items	Cost per Mile
1 Annual straight-line depreciation on car	\$ 2,800	\$ 0.280
2 Cost of gasoline		0.100
3 Annual cost of auto insurance and license	1,360	0.138
4 Maintenance and repairs		0.065
5 Parking fees at school	360	0.036
6 Total average cost		\$ 0.619

Some Additional Information		
7 Reduction in resale value of car per mile of wear		\$ 0.026
8 Round-tip airfare		\$ 104
9 Benefits of relaxing on plane trip		????
10 Cost of putting dog in kennel while gone		\$ 40
1 Benefit of having car in Kuala Lumpur		????
12 Has le of parking car in Kuala Lumpur		????
13 Per day cost of parking car in Kuala Lumpur		\$ 25

Identifying Relevant Costs

Which costs and benefits are relevant in Cynthia's decision?

The cost of the car is a sunk cost and is **not relevant** to the current decision.

The annual cost of insurance is **not relevant**. It will remain the same if she drives or takes the plane.

However, the cost of gasoline is clearly **relevant** if she decides to drive. If she takes the plane, the cost would not be incurred, so it varies depending on the decision.

Identifying Relevant Costs

Which costs and benefits are relevant in Cynthia's decision?

The cost of maintenance and repairs is **relevant**. In the long-run these costs depend upon miles driven.

The monthly school parking fee is **not relevant** because it must be paid if Cynthia drives or takes the plane.

At this point, we can see that some of the average cost of \$0.619 per mile are relevant and others are not.

Identifying Relevant Costs

Which costs and benefits are relevant in Cynthia's decision?

The decline in resale value due to additional miles is a **relevant** cost.

The round-trip airfare is clearly **relevant**. If she drives the cost can be avoided.

Relaxing on the plane is **relevant** even though it is difficult to assign a dollar value to the benefit.

The kennel cost is **not relevant** because Cynthia will incur the cost if she drives or takes the plane.

Identifying Relevant Costs

Which costs and benefits are relevant in Cynthia's decision?

The cost of parking in Kuala Lumpur is **relevant** because it can be avoided if she takes the plane.

The benefits of having a car in Kuala Lumpur and the problems of finding a parking space are both **relevant** but are difficult to assign a dollar amount.

Identifying Relevant Costs

From a financial standpoint, Cynthia would be better off taking the plane to visit her friend. Some of the non-financial factor may influence her final decision.

Relevant Financial Cost of Driving

Gasoline (460 @ \$0.100 per mile)	\$ 46.00
Maintenance (460 @ \$0.065 per mile)	29.90
Reduction in resale (460 @ \$0.026 per mile)	11.96
Parking in Kuala Lumpur (2 days @ \$25 per day)	50.00
Total	\$ 137.86

Relevant Financial Cost of Taking the Plane

Round-trip ticket	\$ 104.00
-------------------	------------------

Total and Differential Cost Approaches

The management of a company is considering a new labor saving machine that rents for \$3,000 per year. Data about the company's annual sales and costs with and without the new machine are:

	Current Situation	Situation With New Machine	Differential Costs and Benefits
Sales (5,000 units @ \$40 per unit)	\$ 200,000	\$ 200,000	-
Less variable expenses:			
Direct materials (5,000 units @ \$14 per unit)	70,000	70,000	-
Direct labor (5,000 units @ \$8 and \$5 per unit)	40,000	25,000	15,000
Variable overhead (5,000 units @ \$2 per unit)	10,000	10,000	-
Total variable expenses	120,000	105,000	-
Contribution margin	80,000	95,000	15,000
Less fixed expense:			
Other	62,000	62,000	-
Rent on new machine	-	3,000	(3,000)
Total fixed expenses	62,000	65,000	(3,000)
Net operating income	\$ 18,000	\$ 30,000	12,000

Total and Differential Cost Approaches

As you can see, the only costs that differ between the alternatives are the direct labor costs savings and the increase in fixed rental costs.

	Current Situation	Situation With New Machine	Differential Costs and Benefits
Sales (5,000 units @ \$40 per unit)	\$ 200,000	\$ 200,000	-
Less variable expenses:			
Direct materials	70,000	70,000	-
Direct labor	40,000	25,000	15,000
Variable overhead	10,000	10,000	-
Total variable expenses	120,000	105,000	-
Contribution margin	80,000	95,000	15,000
Less fixed expense:			
Other	62,000	62,000	-
Rent on new machine	-	3,000	(3,000)
Total fixed expenses	62,000	65,000	(3,000)
Net operating income	\$ 18,000	\$ 30,000	12,000

We can efficiently analyze the decision by looking at the different costs and revenues and arrive at the same solution.

Net Advantage to Renting the New Machine		
Decrease in direct labor costs (5,000 units @ \$3 per unit)	\$ 15,000	-
Increase in fixed rental expenses	(3,000)	(3,000)
Net annual cost saving from renting the new machine	\$ 12,000	12,000

Total and Differential Cost Approaches

Using the differential approach is desirable for two reasons:

1. Only rarely will enough information be available to prepare detailed income statements for both alternatives.
2. Mingling irrelevant costs with relevant costs may cause confusion and distract attention away from the information that is really critical.

Learning Objective 2

①

Prepare an analysis showing whether a product line or other business segment should be dropped or retained.



Adding/Dropping Segments

One of the most important decisions managers make is whether to add or drop a business segment. Ultimately, a decision to drop an old segment or add a new one is going to hinge primarily on the impact the decision will have on net operating income.



To assess this impact, it is necessary to carefully analyze the costs.

Adding/Dropping Segments

Due to the declining popularity of digital watches, Lovell Company's digital watch line has not reported a profit for several years. Lovell is considering discontinuing this product line.



A Contribution Margin Approach

DECISION RULE

Lovell should drop the digital watch segment only if its profit would increase.

Lovell will compare the contribution margin that would be lost to the costs that would be avoided if the line was to be dropped.

Let's look at this solution.



Adding/Dropping Segments



Segment Income Statement Digital Watches

Sales		\$ 500,000
Less: variable expenses		
Variable manufacturing costs	\$ 120,000	
Variable shipping costs	5,000	
Commissions	75,000	200,000
Contribution margin		\$ 300,000
Less: fixed expenses		
General factory overhead	\$ 60,000	
Salary of line manager	90,000	
Depreciation of equipment	50,000	
Advertising - direct	100,000	
Rent - factory space	70,000	
General admin. expenses	30,000	400,000
Net operating loss		\$ (100,000)

Adding/Dropping Segments



Segment Income Statement Digital Watches

Sales \$ 500,000

An investigation has revealed that the fixed general factory overhead and fixed general administrative expenses will not be affected by dropping the digital watch line. The fixed general factory overhead and general administrative expenses assigned to this product would be reallocated to other product lines.

Advertising - direct	100,000	
Rent - factory space	70,000	
General admin. expenses	30,000	400,000
Net operating loss		<u>\$ (100,000)</u>

Adding/Dropping Segments



Segment Income Statement Digital Watches

Sales \$ 500,000

Less: variable expenses

Cost of goods sold

200,000

\$ 300,000

Less: fixed expenses

General factory overhead	\$ 60,000	
Salary of line manager	90,000	
Depreciation of equipment	70,000	
Advertising - direct	100,000	
Rent - factory space	70,000	
General admin. expenses	30,000	400,000
Net operating loss		<u>\$ (100,000)</u>

The equipment used to manufacture digital watches has no resale value or alternative use.

Should Lovell retain or drop the digital watch segment?

A Contribution Margin Approach

Contribution Margin Solution		
Contribution margin lost if digital watches are dropped		\$ (300,000)
Less fixed costs that can be avoided		
Salary of the line manager	\$ 90,000	
Advertising - direct	100,000	
Rent - factory space	70,000	260,000
Net disadvantage		\$ (40,000)



Comparative Income Approach

The Lovell solution can also be obtained by preparing comparative income statements showing results with and without the digital watch segment.

Let's look at this second approach.



Comparative Income Approach Solution			
	Keep Digital Watches	Drop Digital Watches	Difference
Sales	\$ 500,000	\$ -	\$ (500,000)
Less variable expenses:			
Manufacturing expenses	120,000	-	120,000
Shipping	5,000	-	5,000
Commissions	75,000	-	75,000
Total variable expenses	200,000	-	200,000
Contribution margin	300,000	-	(300,000)
Less fixed expenses:			
General factory overhead	60,000		
Salary of line manager	90,000		
Depreciation	50,000		
Advertising - direct	100,000		
Rent - factory space	70,000		
General admin. expenses	30,000		
Total fixed expenses	400,000		
Net operating loss	\$ (100,000)		

If the digital watch line is dropped, the company loses \$300,000 in contribution margin.

Comparative Income Approach Solution			
	Keep Digital Watches	Drop Digital Watches	Difference
Sales	\$ 500,000	\$ -	\$ (500,000)
Less variable expenses:			
Manufacturing expenses	120,000	-	120,000
Shipping	5,000	-	5,000
Commissions	75,000	-	75,000
Total variable expenses	200,000	-	200,000
Contribution margin	300,000	-	(300,000)
Less fixed expenses:			
General factory overhead	60,000	60,000	-
Salary of line manager	90,000		
Depreciation			
Advertising - direct			
Rent - factory space			
General admin. expenses			
Total fixed expenses			
Net operating loss			

On the other hand, the general factory overhead would be the same under both alternatives, so it is irrelevant.

Comparative Income Approach Solution			
	Keep Digital Watches	Drop Digital Watches	Difference
Sales	\$ 500,000	\$ -	\$ (500,000)
Less variable expenses:			
Manufacturing expenses			120,000
Shipping			5,000
Commissions			75,000
Total variable expenses	200,000	-	200,000
Contribution margin	300,000	-	(300,000)
Less fixed expenses:			
General factory overhead	60,000	60,000	-
Salary of line manager	90,000	-	90,000
Depreciation	50,000		
Advertising - direct	100,000		
Rent - factory space	70,000		
General admin. expenses	30,000		
Total fixed expenses	400,000		
Net operating loss	\$ (100,000)		

The salary of the product line manager would disappear, so it is relevant to the decision.

Comparative Income Approach Solution			
	Keep Digital Watches	Drop Digital Watches	Difference
Sales	\$ 500,000	\$ -	\$ (500,000)
Less variable expenses:			
Manufacturing expenses			120,000
Shipping			5,000
Commissions			75,000
Total variable expenses	200,000	-	200,000
Contribution margin	300,000	-	(300,000)
Less fixed expenses:			
General factory overhead	60,000	60,000	-
Salary of line manager	90,000	-	90,000
Depreciation	50,000	50,000	-
Advertising - direct	100,000		
Rent - factory space	70,000		
General admin. expenses	30,000		
Total fixed expenses	400,000		
Net operating loss	\$ (100,000)		

The depreciation is a sunk cost. Also, remember that the equipment has no resale value or alternative use, so the equipment and the depreciation expense associated with it are irrelevant to the decision.

Comparative Income Approach Solution			
	Keep Digital Watches	Drop Digital Watches	Difference
Sales	\$ 500,000	\$ -	\$ (500,000)
Less variable expenses:			
Manufacturing expense	100,000	-	100,000
Shipping	5,000	-	5,000
Commissions	75,000	-	75,000
Total variable expenses	180,000	-	180,000
Contribution margin	320,000	-	320,000
Less fixed expenses:			
General factory overhead	-	-	-
Salary of line manager	100,000	-	100,000
Depreciation	50,000	50,000	-
Advertising - direct	100,000	-	100,000
Rent - factory space	70,000	-	70,000
General admin. expenses	30,000	30,000	-
Total fixed expenses	400,000	140,000	260,000
Net operating loss	\$ (100,000)	\$ (140,000)	\$ (40,000)

The complete comparative income statements reveal that Lovell would earn \$40,000 of additional profit by retaining the digital watch line.

Beware of Allocated Fixed Costs

Why should we keep the digital watch segment when it's showing a **\$100,000 loss**?



Beware of Allocated Fixed Costs

The answer lies in the way we allocate common fixed costs to our products.

*have to pay regardless
=> another department
pick up the cost*

*UNLESS
"incremental"
fixed cost,
then
avoidable*



Beware of Allocated Fixed Costs

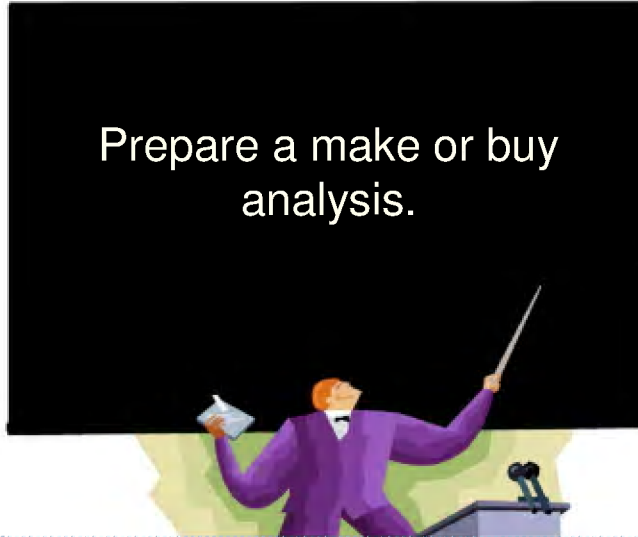
Including **unavoidable common fixed costs** makes the product line appear to be unprofitable.

Our allocations can make a segment look **less profitable** than it really is.



Learning Objective 3

Prepare a make or buy analysis.



The Make or Buy Decision

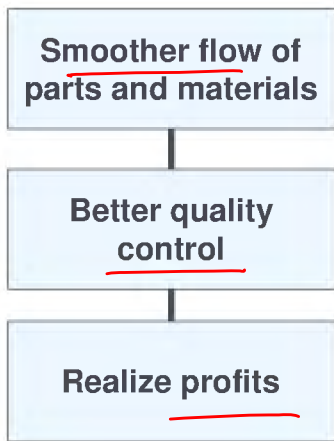
When a company is involved in more than one activity in the entire value chain, it is vertically integrated. A decision to carry out one of the activities in the value chain internally, rather than to buy externally from a supplier is called a “make or buy” decision.



*outsourcing
= buy*

*strategy
part,
non-\$*

Vertical Integration- Advantages



make it by backward - buy supplier forward - buy customer

disadvantages

adv outsourcing - buy

Vertical Integration- Disadvantage

Companies may fail to take advantage of suppliers who can create **economies of scale advantage** by **pooling demand from numerous companies.**



While the **economies of scale** factor can be appealing, a company must be careful to retain control over activities that are essential to maintaining its competitive position.

e.g. chips & lens in phones

The Make or Buy Decision: An Example

- ▶ Essex Company manufactures part 4A that is used in one of its products.
- ▶ The unit product cost of this part is:

Direct materials	\$ 9
Direct labor	5
Variable overhead	1
Depreciation of special equip.	3
Supervisor's salary	2
General factory overhead	10
Unit product cost	\$ 30

The Make or Buy Decision

- ▶ The special equipment used to manufacture part 4A has no resale value.
- ▶ The total amount of general factory overhead, which is allocated on the basis of direct labor hours, would be unaffected by this decision.
- ▶ The \$30 unit product cost is based on 20,000 parts produced each year.
- ▶ An outside supplier has offered to provide the 20,000 parts at a cost of \$25 per part.

Should we accept the supplier's offer?

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	\$ 25		\$ 500,000
Direct materials (20,000 units)	\$ 9	180,000	
Direct labor	5	100,000	
Variable overhead	1	20,000	
Depreciation of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	\$ 30	\$ 340,000	\$ 500,000

The **avoidable costs** associated with making part 4A include direct materials, direct labor, variable overhead, and the supervisor's salary.

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	\$ 25		\$ 500,000
Direct materials (20,000 units)	\$ 9	180,000	
Direct labor	5	100,000	
Variable overhead	1	20,000	
Depreciation of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	\$ 30	\$ 340,000	\$ 500,000

The depreciation of the special equipment represents a **sunk cost**. The equipment has no resale value, thus its cost and associated depreciation are irrelevant to the decision.

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	\$ 25		\$ 500,000
Direct materials (20,000 units)	\$ 9	180,000	
Direct labor	5	100,000	
Variable overhead	1	20,000	
Depreciation of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	\$ 30	\$ 340,000	\$ 500,000

Not avoidable; irrelevant. If the product is dropped, it will be reallocated to other products.

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	\$ 25		\$ 500,000
Direct materials (20,000 units)	\$ 9	180,000	
Direct labor	5	100,000	
Variable overhead	1	20,000	
Depreciation of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	\$ 30	\$ 340,000	\$ 500,000

Should we make or buy part 4A? Given that the total avoidable costs are less than the cost of buying the part, Essex should continue to make the part.

Opportunity Cost

± option value

** strategy must consider*

An **opportunity cost** is the benefit that is foregone as a result of pursuing some course of action.

Opportunity costs are not actual cash outlays and are not recorded in the formal accounts of an organization.

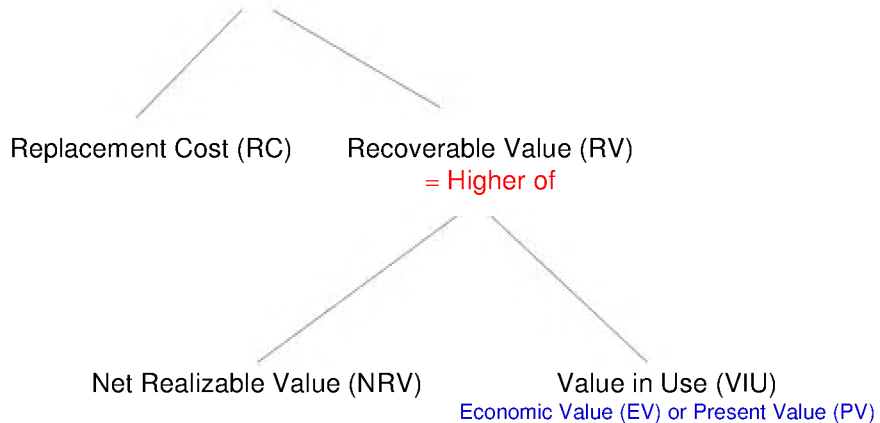
"hidden" value ?

How would this concept potentially relate to the Essex Company?



Value to Business (Deprival Value)

Deprival value
= Lower of



asset

Opportunity Costs: An Example

Fed Co. Ltd. is considering the publication of a limited edition of a book, bound in a special grade of leather.

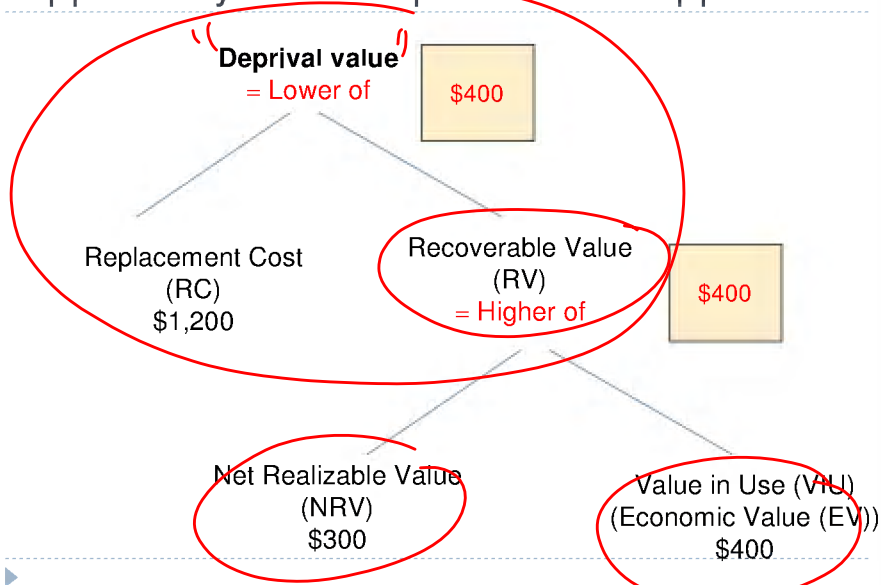
- The leather was bought some year ago for \$500. *buy*
- The current price for the same quantity of leather would be \$1,200
- Fed Co. Ltd. Can use the leather to cover desk furnishings, in replacement for other material which would cost \$400
- Fed Co. Ltd. can sell it with a net disposal proceeds of \$300



How much should the leather be valued for the use of book bounding?

Opportunity Cost: Deprival Value Approach

*- inventory
- machine time
- labor*



*excess,
no use,
other use*

Learning Objective 4

4

Prepare an analysis showing whether a special order should be accepted.

- fixed cost
- excess capacity

Key Terms and Concepts

A **special order** is a one-time order that is not considered part of the company's normal ongoing business.

When analyzing a special order, only the **incremental costs and benefits** are relevant.

Since the existing fixed manufacturing overhead costs would not be affected by the order, they are not relevant.



strategic reasons?

no fixed cost incurred
(VC)

unless at full capacity

Special Orders

- **Jet Corporation** makes a single product whose normal selling price is \$20 per unit.
- A foreign distributor offers to purchase 3,000 units for \$10 per unit.
- This is a one-time order that would not affect the company's regular business.
- Annual capacity is 10,000 units, but Jet Corporation is currently producing and selling only 5,000 units.

Should Jet accept the offer?

Special Orders

Jet Corporation		
Contribution Income Statement		
Revenue (5,000 × \$20)		\$ 100,000
Variable costs:		
Direct materials	\$ 20,000	
Direct labor	5,000	
Manufacturing overhead	10,000	\$8 variable cost
Marketing costs	5,000	
Total variable costs		40,000
Contribution margin		60,000
Fixed costs:		
Manufacturing overhead	\$ 28,000	
Marketing costs	20,000	
Total fixed costs		48,000
Net operating income		\$ 12,000

Special Orders

If Jet accepts the special order, the incremental revenue will exceed the incremental costs. In other words, net operating income will increase by \$6,000. This suggests that Jet should accept the order.

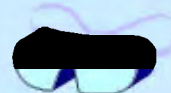
Increase in revenue (3,000 × \$10)	\$30,000
Increase in costs (3,000 × \$8 variable cost)	24,000
Increase in net income	<u>\$ 6,000</u>

Note: This answer assumes that the fixed costs are **unavoidable** and that variable marketing costs must be incurred on the special order.

Quick Check ✓

Northern Optical ordinarily sells the X-lens for \$50. The variable production cost is \$10, the fixed production cost is \$18 per unit, and the variable selling cost is \$1. A customer has requested a special order for 10,000 units of the X-lens to be imprinted with the customer's logo. This special order would not involve any selling costs, but Northern Optical would have to purchase an imprinting machine for \$50,000.

(see the next page)



Quick Check ✓

What is the rock bottom minimum price below which Northern Optical should not go in its negotiations with the customer? In other words, below what price would Northern Optical actually be losing money on the sale? There is ample idle capacity to fulfill the order and the imprinting machine has no further use after this order.

- a. \$50
- b. \$10
- c. \$15
- d. \$29



Quick Check ✓



What is the rock bottom minimum price below which Northern Optical should not go in its negotiations with the customer? In other words, below what price would Northern Optical actually be losing money on the sale? There is ample idle capacity to fulfill the order and the imprinting machine has no further use after this order.

- a. \$50
- b. \$10
- c. \$15**
- d. \$29

Variable production cost	\$100,000
Additional fixed cost	+ 50,000
Total relevant cost	<u>\$150,000</u>
Number of units	10,000
Average cost per unit=	\$15

Learning Objective 5

Determine the most profitable use of a constrained resource and the value of obtaining more of the constrained resource.

order of production

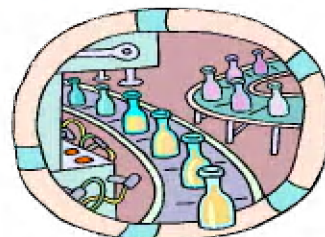
theory of constraint (TOC)

Key Terms and Concepts

thru-put accounting

When a limited resource of some type restricts the company's ability to satisfy demand, the company is said to have a **constraint**.

The machine or process that is limiting overall output is called the bottleneck - it is the constraint.



Utilization of a Constrained Resource

- ▶ Fixed costs are usually unaffected in these situations, so the product mix that maximizes the company's total contribution margin should ordinarily be selected.
- ▶ A company should not necessarily promote those products that have the highest unit contribution margins.
- ▶ Rather, total contribution margin will be maximized by promoting those products or accepting those orders that provide the highest contribution margin in relation to the constraining resource.

Utilization of a Constrained Resource: An Example

Ensign Company produces two products and selected data are shown below:

	Product	
	1	2
Selling price per unit	\$ 60	\$ 50
Less variable expenses per unit	36	35
Contribution margin per unit	\$ 24	\$ 15
Current demand per week (units)	2,000	2,200
Contribution margin ratio	40%	30%
Processing time required on machine A1 per unit	1.00 min.	0.50 min.

Order
make 2000 product 1
product 2

Utilization of a Constrained Resource: An Example

- ▶ **Machine A1 is the constrained resource and is being used at 100% of its capacity.**
- ▶ **There is excess capacity on all other machines.**
- ▶ **Machine A1 has a capacity of 2,400 minutes per week.**

Should Ensign focus its efforts on Product 1 or Product 2?

Quick Check ✓

How many units of each product can be processed through Machine A1 in one minute?

	<u>Product 1</u>	<u>Product 2</u>
a.	1 unit	0.5 unit
b.	1 unit	2.0 units
c.	2 units	1.0 unit
d.	2 units	0.5 unit

Quick Check ✓

How many units of each product can be processed through Machine A1 in one minute?

	<u>Product 1</u>	<u>Product 2</u>
a.	1 unit	0.5 unit
b.	1 unit	2.0 units
c.	2 units	1.0 unit
d.	2 units	0.5 unit

Just checking to make sure you are with us.

Quick Check ✓

What generates more profit for the company, using one minute of machine A1 to process Product 1 or using one minute of machine A1 to process Product 2?

- Product 1
- Product 2
- They both would generate the same profit.
- Cannot be determined.

Quick Check ✓

With one minute of machine A1, we could make 1 unit of Product 1, with a contribution margin of \$24, or 2 units of Product 2, each with a contribution margin of \$15.

$$2 \times \$15 = \$30 > \$24$$

b. Product 2

- c. They both would generate the same profit.
d. Cannot be determined.

Utilization of a Constrained Resource

The key is the contribution margin per unit of the constrained resource.

	Product	
	1	2
Contribution margin per unit	\$ 24	\$ 15
Time required to produce one unit	1.00 min.	0.50 min.
<u>Contribution margin per minute</u>	\$ 24	\$ 30

Ensign should emphasize **Product 2** because it generates a contribution margin of \$30 per minute of the constrained resource relative to \$24 per minute for Product 1.

st
2200 product 2
)

Utilization of a Constrained Resource

The key is the contribution margin per unit of the constrained resource.

	Product	
	1	2
Contribution margin per unit	\$ 24	\$ 15
Time required to produce one unit	÷ 1.00 min.	÷ 0.50 min.
Contribution margin per minute	\$ 24	\$ 30

Ensign can maximize its contribution margin by first producing **Product 2** to meet customer demand and then using any remaining capacity to produce Product 1. The calculations would be performed as follows.

Utilization of a Constrained Resource

Let's see how this plan would work.

Alloting Our Constrained Resource (Machine A1)

Weekly demand for Product 2		2,200 units
Time required per unit	×	0.50 min.
Total time required to make Product 2		<u>1,100 min.</u>
		<u> </u>
		<u> </u>
		<u> </u>

Utilization of a Constrained Resource

Let's see how this plan would work.

Alloting Our Constrained Resource (Machine A1)

Weekly demand for Product 2	2,200 units	
Time required per unit	× 0.50 min.	
Total time required to make Product 2	<u>1,100 min.</u>	
Total time available	2,400 min.	
Time used to make Product 2	<u>1,100 min.</u>	
Time available for Product 1	<u>1,300 min.</u>	
	<u> </u>	
	<u> </u>	

20w

Utilization of a Constrained Resource

Let's see how this plan would work.

Alloting Our Constrained Resource (Machine A1)

Weekly demand for Product 2	2,200 units	
Time required per unit	× 0.50 min.	
Total time required to make Product 2	<u>1,100 min.</u>	
Total time available	2,400 min.	
Time used to make Product 2	<u>1,100 min.</u>	
Time available for Product 1	1,300 min.	
Time required per unit	÷ 1.00 min.	
Production of Product 1	<u>1,300 units</u>	

Utilization of a Constrained Resource

According to the plan, we will produce 2,200 units of Product 2 and 1,300 of Product 1. Our contribution margin looks like this.

	<u>Product 1</u>	<u>Product 2</u>
Production and sales (units)	1,300	2,200
Contribution margin per unit	\$ 24	\$ 15
Total contribution margin	<u>\$ 31,200</u>	<u>\$ 33,000</u>

The total contribution margin for Ensign is \$64,200.

Quick Check ✓

Colonial Heritage makes reproduction colonial furniture from select hardwoods.

	<i>Chairs</i>	<i>Tables</i>
Selling price per unit	\$80	\$400
Variable cost per unit	\$30	\$200
Board feet per unit	2	10
Monthly demand	600	100

The company's supplier of hardwood will only be able to supply 2,000 board feet this month. Is this enough hardwood to satisfy demand?

- Yes
- No

Quick Check ✓

Colonial Heritage makes reproduction colonial furniture from select hardwoods.

	<i>Chairs</i>	<i>Tables</i>
Selling price per unit	\$80	\$400
Variable cost per unit	\$30	\$200
Board feet per unit	2	10
Monthly demand	600	100

The company's supplier of hardwood will only be able to supply 2,000 board feet this month. Is this enough hardwood to satisfy demand?

a. Yes

b. No

$$(2 \times 600) + (10 \times 100) = 2,200 > 2,000$$

Quick Check ✓

	<i>Chairs</i>	<i>Tables</i>
Selling price per unit	\$80	\$400
Variable cost per unit	\$30	\$200
Board feet per unit	2	10
Monthly demand	600	100

The company's supplier of hardwood will only be able to supply 2,000 board feet this month. What plan would maximize profits?

- a. 500 chairs and 100 tables
- b. 600 chairs and 80 tables**
- c. 500 chairs and 80 tables
- d. 600 chairs and 100 tables

Quick Check ✓

Selling price
Variable cost
Board feet per
Monthly dem

The company's supplier
be able to supply
What plan would

- a. 500 chairs and 100 tables
b. 600 chairs and 80 tables
 c. 500 chairs and 80 tables
 d. 600 chairs and 100 tables

	Chairs	Tables
Selling price	\$ 80	\$ 400
Variable cost	30	200
Contribution margin	\$ 50	\$ 200
Board feet	2	10
CM per board foot	\$ 25	\$ 20
Production of chairs	600	
Board feet required	1,200	
Board feet remaining	800	
Board feet per table	10	
Production of tables		80

Quick Check ✓

As before, Colonial Heritage's supplier of hardwood will only be able to supply 2,000 board feet this month. Assume the company follows the plan we have proposed. Up to how much should Colonial Heritage be willing to pay above the usual price to obtain more hardwood?

- a. \$40 per board foot
 b. \$25 per board foot
 c. \$20 per board foot
 d. Zero

Quick Check ✓

As before, Colonial Heritage's supplier of hardwood
 The additional wood would be used to make
 tables. In this use, each board foot of
 additional wood will allow the company to earn
 an additional \$20 of contribution margin and
 profit.

- a. \$40 per board foot
- b. \$25 per board foot
- c. \$20 per board foot**
- d. Zero

* SMA - comparison of these alternatives

*

*

Managing Constraints ✓

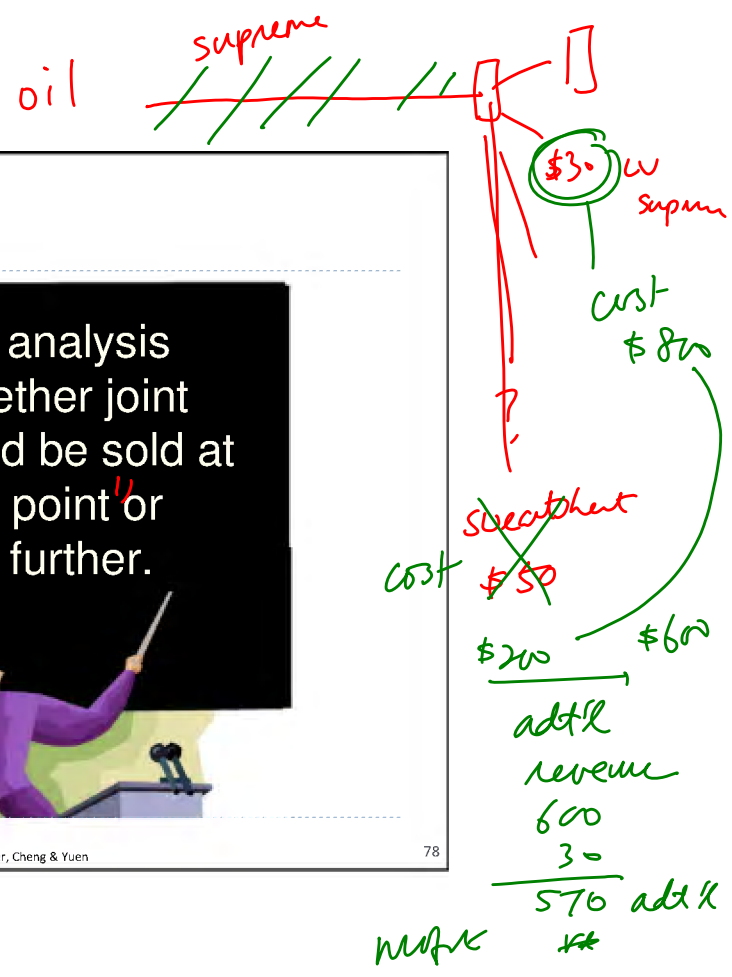
It is often possible for a manager to increase the capacity of a bottleneck, which is called relaxing (or elevating) the constraint, in numerous ways such as:

1. Working overtime on the bottleneck.
2. Subcontracting some of the processing that would be done at the bottleneck.
3. Investing in additional machines at the bottleneck.
4. Shifting workers from non-bottleneck processes to the bottleneck.
5. Focusing business process improvement efforts on the bottleneck.
6. Reducing defective units processed through the bottleneck.

These methods and ideas are all consistent with the Theory of Constraints, which was introduced in Chapter 1.

TOC

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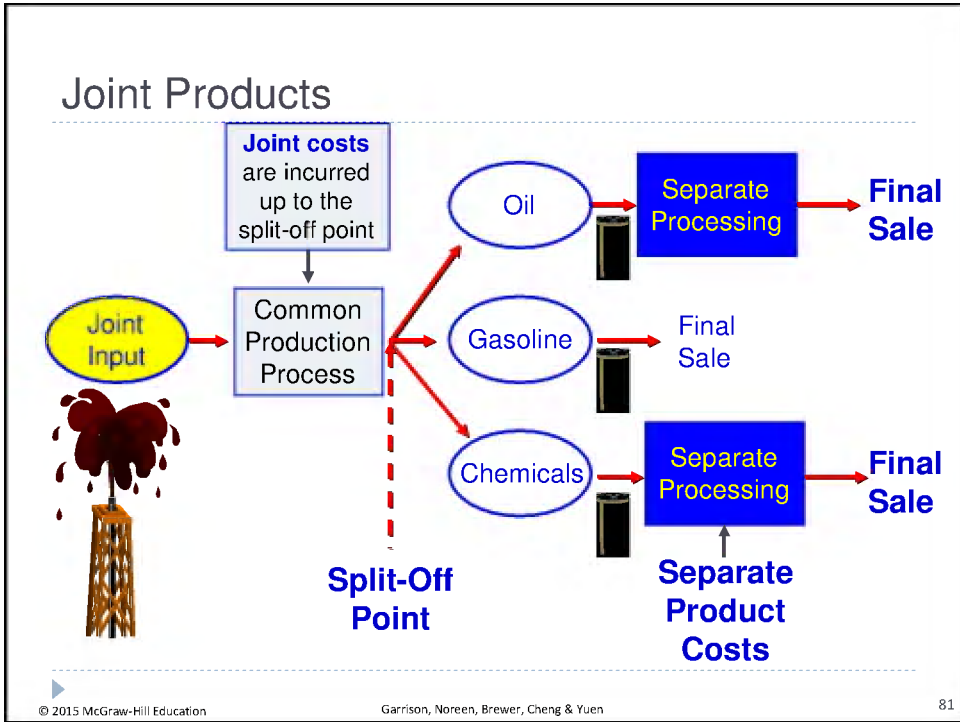
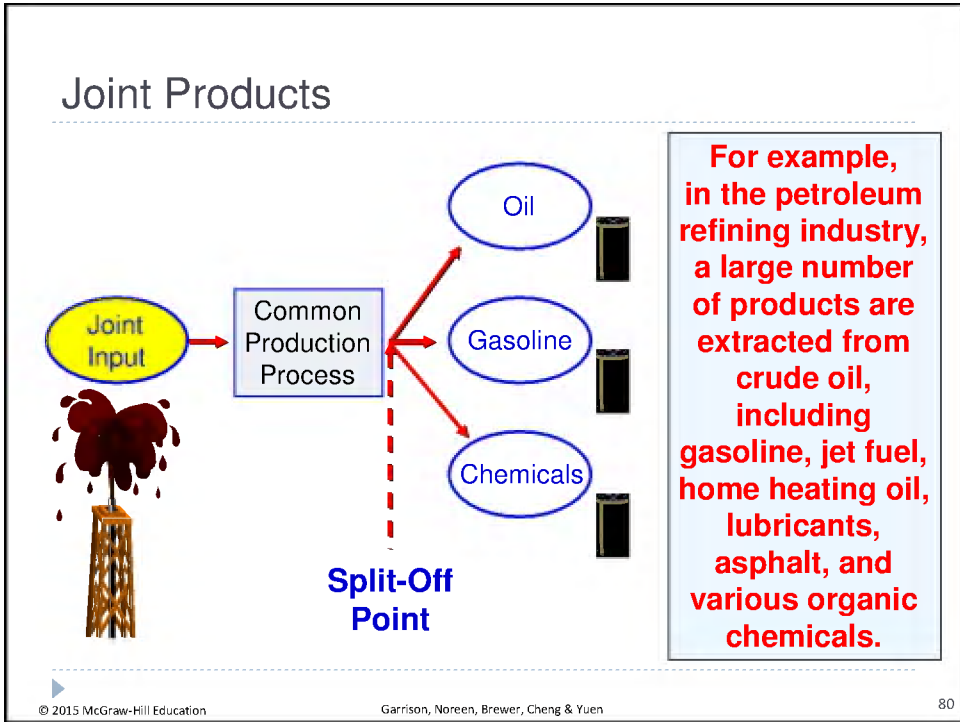


Learning Objective 6

Prepare an analysis showing whether joint products should be sold at the split-off point or processed further.

Joint Costs

- ▶ In some industries, a number of end products are produced from a single raw material input.
- ▶ Two or more products produced from a common input are called **joint products**.
- ▶ The point in the manufacturing process where each joint product can be recognized as a separate product is called the **split-off point**.



The Pitfalls of Allocation



Joint costs are traditionally allocated among different products at the split-off point. A typical approach is to allocate joint costs according to the relative sales value of the end products.

Although allocation is needed for some purposes such as balance sheet inventory valuation, allocations of this kind are **very dangerous** for decision making.

Sell or Process Further

Joint costs are irrelevant in decisions regarding what to do with a product from the split-off point forward. Therefore, these costs should not be allocated to end products for decision-making purposes.

With respect to sell or process further decisions, it is profitable to continue processing a joint product after the split-off point so long as the incremental revenue from such processing exceeds the incremental processing costs incurred after the split-off point.

Sell or Process Further: An Example

- ▶ Sawmill, Inc. cuts logs from which unfinished lumber and sawdust are the immediate joint products.
- ▶ Unfinished lumber is sold “as is” or processed further into finished lumber.
- ▶ Sawdust can also be sold “as is” to gardening wholesalers or processed further into “presto-logs.”



Sell or Process Further

Data about Sawmill’s joint products includes:

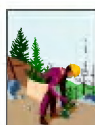
	Per Log	
	Lumber	Sawdust
Sales value at the split-off point	\$ 140	\$ 40
Sales value after further processing	270	50
Allocated joint product costs	176	24
Cost of further processing	50	20



Sell or Process Further

Analysis of Sell or Process Further

	Per Log	
	Lumber	Sawdust
Sales value after further processing	\$ 270	\$ 50
Sales value at the split-off point	140	40
Incremental revenue	130	10
Cost of further processing		
Profit (loss) from further processing		



Sell or Process Further

Analysis of Sell or Process Further

	Per Log	
	Lumber	Sawdust
Sales value after further processing	\$ 270	\$ 50
Sales value at the split-off point	140	40
Incremental revenue	130	10
Cost of further processing	50	20
Profit (loss) from further processing	\$ 80	\$ (10)



Sell or Process Further

Analysis of Sell or Process Further

	Per Log	
	Lumber	Sawdust
Sales value after further processing	\$ 270	\$ 50
Sales value at the split-off point	140	40
Incremental revenue	130	10
Cost of further processing	50	20
Profit (loss) from further processing	\$ 80	\$ (10)

The lumber should be processed further and the sawdust should be sold at the split-off point.



Activity-Based Costing and Relevant Costs

ABC can be used to help identify **potentially** relevant costs for decision-making purposes.

However, managers should exercise caution against reading more into this "traceability" than really exists.



People have a tendency to assume that if a cost is traceable to a segment, then the cost is automatically avoidable, which is untrue.

Before making a decision, managers must decide which of the potentially relevant costs are actually avoidable.

End of Chapter 14



ACCA

HK OP }
CPA Aust } ✓

6

Short-term decisions

CICA X

Topic list	Syllabus reference
1 Identifying relevant costs	B1 (a), (b), (c)
2 Make or buy decisions	B5 (a), (b), (c)
3 Outsourcing	B5 (a), (b), (c)
4 Further processing decisions	B5 (d)
5 Shut down decisions	B5 (d)

Introduction

The concept of **relevant costs** has already been revisited in this study text and their use in one-off contracts was examined in the last chapter.

In this chapter we look in greater depth at relevant costs and at how they should be applied in **decision-making situations**.

We look at a variety of common short-run business decisions and consider how they can be dealt with using relevant costs as appropriate.

Study guide

		Intellectual level
B1	Relevant cost analysis	
(a)	Explain the concept of relevant costing	2
(b)	Identify and calculate relevant costs for specific decision situations from given data	2
(c)	Explain and apply the concept of opportunity costs	2
B5	Make-or-buy and other short-term decisions	
(a)	Explain the issues surrounding make vs buy and outsourcing decisions	2
(b)	Calculate and compare 'make' costs with 'buy-in' costs	2
(c)	Compare in-house costs and outsource costs of completing tasks and consider other issues surrounding this decision	2
(d)	Apply relevant costing principles in situations involving shut down, one-off contracts and the further processing of joint products	2

Exam guide

The ability to recognise relevant costs and revenues is a key skill for the F5 exam and is highly examinable. Questions will be based on practical scenarios.



One of the competencies you require to fulfil performance objective 12 of the PER is the ability to prepare management information to assist in decision making. You can apply the knowledge you obtain from this section of the text to help to demonstrate this competence.

1 Identifying relevant costs

12/11

FAST FORWARD

Relevant costs are future cash flows arising as a direct consequence of a decision.

- Relevant costs are **future costs** ← sunk cost / committed cost
- Relevant costs are **cash flows** ← dep'n
- Relevant costs are **"incremental costs"** avoidable

"except" interest expense

In this section we provide a fairly gentle introduction to the sort of thought processes that you will have to go through when you encounter a decision-making question. First some general points about machinery, labour, and particularly materials, that often catch people out.

do not include in analysis "included in discount rate"

Exam focus point

Question 1 of the December 2011 exam asked candidates to prepare a cost statement using relevant costing principles, with detailed notes to support each number included in the statement.

The examiner noted that many candidates 'just wrote down that a cost was included because it was relevant, but didn't say why'. Ensure you are able to explain **why** a cost is relevant / not relevant to a decision.

already"

1.1 Machinery user costs

Once a machine has been bought its cost is a **sunk cost**. **Depreciation** is not a relevant cost, because it is not a cash flow. However, **using** machinery may involve some incremental costs. These costs might be

referred to as **user costs** and they include hire charges and any fall in resale value of owned assets, through use.

1.1.1 Example: Machine user costs

Bronty Co is considering whether to undertake some contract work for a customer. The machinery required for the contract would be as follows.

- (a) A special cutting machine will have to be hired for three months for the work (the length of the contract). Hire charges for this machine are \$75 per month, with a minimum hire charge of \$300.
- (b) All other machinery required in the production for the contract has already been purchased by the organisation on hire purchase terms. The monthly hire purchase payments for this machinery are \$500. This consists of \$450 for capital repayment and \$50 as an interest charge. The last hire purchase payment is to be made in two months time. The cash price of this machinery was \$9,000 two years ago. It is being depreciated on a straight line basis at the rate of \$200 per month. However, it still has a useful life which will enable it to be operated for another 36 months.

The machinery is highly specialised and is unlikely to be required for other, more profitable jobs over the period during which the contract work would be carried out. Although there is no immediate market for selling this machine, it is expected that a customer might be found in the future. It is further estimated that the machine would lose \$200 in its eventual sale value if it is used for the contract work.

What is the relevant cost of machinery for the contract?

Solution

- (a) The **cutting machine** will incur an incremental cost of \$300, the minimum hire charge.
- (b) The historical cost of the **other machinery** is irrelevant as a past cost; depreciation is irrelevant as a non-cash cost; and future hire purchase repayments are irrelevant because they are committed costs. The only relevant cost is the loss of resale value of the machinery, estimated at \$200 through use. This 'user cost' will not arise until the machinery is eventually resold and the \$200 should be discounted to allow for the time value of money. However, discounting is ignored here, and will be discussed in a later chapter.

(c) Summary of relevant costs		\$
Incremental hire costs	<i>irrelevant</i>	300
User cost of other machinery	<i>alternative use relevant cost</i>	200
		500

1.2 Labour *"idle" - not working* *alternative use relevant cost* *busy - relevant cost*

Often the labour force will be paid irrespective of the decision made and the costs are therefore **not incremental**. Take care, however, if the labour force could be put to an **alternative use**, in which case the relevant costs are the **variable costs** of the labour and associated variable overheads **plus the contribution forgone** from not being able to put it to its alternative use.

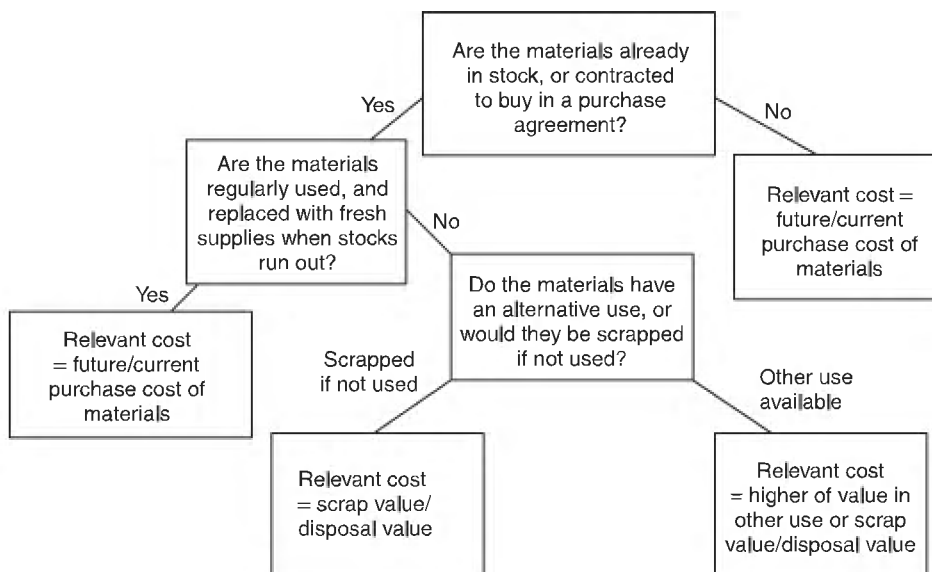
1.3 Materials

The relevant cost of raw materials is generally their current **replacement** cost, unless the materials have already been purchased and would not be replaced once used.

If materials have already been purchased but will not be replaced, then the relevant cost of using them is **either** (a) their current **resale value** or (b) the value they would obtain if they were put to an **alternative use**, if this is greater than their current resale value.

The **higher** of (a) or (b) is then the opportunity cost of the materials. If the materials have no resale value and no other possible use, then the relevant cost of using them for the opportunity under consideration would be nil.

The flowchart below shows how the relevant costs of materials can be identified, provided that the materials are not in short supply, and so have no internal opportunity cost.



Question

Relevant cost of materials

O'Reilly Co has been approached by a customer who would like a special job to be done for him, and who is willing to pay \$22,000 for it. The job would require the following materials:

Material	Total units required	Units already in inventory	Book value of units in inventory \$/unit	Realisable value \$/unit	Replacement cost \$/unit
A	1,000	0	–	–	6
B	1,000	600	2	2.5	5
C	1,000	700	3	2.5	4
D	200	200	4	6.0	9

- Material B is used regularly by O'Reilly Ltd, and if units of B are required for this job, they would need to be replaced to meet other production demand.
- Materials C and D are in inventory as the result of previous over-buying, and they have a restricted use. No other use could be found for material C, but the units of material D could be used in another job as substitute for 300 units of material E, which currently costs \$5 per unit (of which the company has no units in inventory at the moment).

What are the relevant costs of material, in deciding whether or not to accept the contract?

Answer

- Material A** is not owned and would have to be bought in full at the replacement cost of \$6 per unit.
- Material B** is used regularly by the company. There is existing inventory (600 units) but if these are used on the contract under review a further 600 units would be bought to replace them. Relevant costs are therefore 1,000 units at the replacement cost of \$5 per unit.
- Material C:** 1,000 units are needed and 700 are already in inventory. If used for the contract, a further 300 units must be bought at \$4 each. The existing inventory of 700 will not be replaced. If they are used for the contract, they could not be sold at \$2.50 each. The realisable value of these 700 units is an opportunity cost of sales revenue forgone.
- Material D:** these are already in inventory and will not be replaced. There is an opportunity cost of using D in the contract because there are alternative opportunities either to sell the existing

inventory for \$6 per unit (\$1,200 in total) or avoid other purchases (of material E), which would cost $300 \times \$5 = \$1,500$. Since substitution for E is more beneficial, \$1,500 is the opportunity cost.

(e) **Summary of relevant costs**

	\$
Material A (1,000 × \$6)	6,000
Material B (1,000 × \$5)	5,000
Material C (300 × \$4) plus (700 × \$2.50)	2,950
Material D	1,500
Total	<u>15,450</u>

1.4 Opportunity costs

Other potential relevant costs include **opportunity costs**.

Opportunity cost is the **"benefit sacrificed"** by choosing one opportunity rather than the next best alternative. You will often encounter opportunity costs when there are several possible uses for a scarce resource.

For example, if a material is in short supply, it may be transferred from the production of one product to that of another product. The opportunity cost is the **"contribution lost"** from ceasing production of the original product.

Key term

Opportunity cost is the value of a benefit sacrificed when one course of action is chosen, in preference to an alternative. The opportunity cost is represented by the forgone potential benefit from the best rejected course of action.



Question

An information technology consultancy firm has been asked to do an urgent job by a client, for which a price of \$2,500 has been offered. The job would require the following.

- (a) 30 hours' work from one member of staff, who is paid on an hourly basis, at a rate of \$20 per hour, but who would normally be employed on work for clients where the charge-out rate is \$45 per hour. No other member of staff is able to do the member of staff in question's work.
- (b) The use of 5 hours of mainframe computer time, which the firm normally charges out to external users at a rate of \$50 per hour. Mainframe computer time is currently used 24 hours a day, 7 days a week.
- (c) Supplies and incidental expenses of \$200.

Required

Fill in the blank in the sentence below.

The relevant cost or opportunity cost of the job is \$.....

Answer

The correct answer is \$1,800.

The relevant cost or opportunity cost of the job would be calculated as follows.

	\$
Labour (30 hours × \$45)	1,350
Computer time opportunity cost (5 hours × \$50)	250
Supplies and expenses	200
	<u>1,800</u>



office, do not need, rent out at \$500/mo

I am using the office

myself, must take back the office,

Opportunity costs

FAST FORWARD

In a **make or buy decision** with no limiting factors, the relevant costs are the differential costs between the two options.

A make or buy problem involves a decision by an organisation about **whether it should make a product or whether it should pay another organisation to do so**. Here are some examples of make or buy decisions.

- (a) Whether a company should manufacture its own components, or else buy the components from an outside supplier
- (b) Whether a construction company should do some work with its own employees, or whether it should sub-contract the work to another company
- (c) Whether a service should be carried out by an internal department or whether an external organisation should be employed (discussed more fully later in this chapter)

The **'make'** option should give **management more direct control** over the work, but the **'buy'** option often has the benefit that the **external organisation** has a **specialist skill** and expertise in the work. Make or buy decisions should certainly **not be based exclusively on cost considerations**.

If an organisation has the freedom of choice about whether to make internally or buy externally and has no scarce resources that put a restriction on what it can do itself, the **relevant costs** for the decision will be the **differential costs** between the two options.

2.1 Example: Make or buy decision

Shellfish Co makes four components, W, X, Y and Z, for which costs in the forthcoming year are expected to be as follows.

	W	X	Y	Z
Production (units)	1,000	2,000	4,000	3,000
<i>Unit marginal costs</i>				
Direct materials	\$ 4	\$ 5	\$ 2	\$ 4
Direct labour	8	9	4	6
Variable production overheads	2	3	1	2
	<u>14</u>	<u>17</u>	<u>7</u>	<u>12</u>

Directly attributable fixed costs per annum and committed fixed costs:

	\$
Incurred as a direct consequence of making W	1,000
Incurred as a direct consequence of making X	5,000
Incurred as a direct consequence of making Y	6,000
Incurred as a direct consequence of making Z	8,000
Other fixed costs (committed)	30,000
	<u>50,000</u>

A sub-contractor has offered to supply units of W, X, Y and Z for \$12, \$21, \$10 and \$14 respectively. Should Shellfish make or buy the components?

Solution

- (a) The **relevant costs** are the differential costs between making and buying, and they consist of **differences in unit variable costs plus differences in directly attributable fixed costs**. Sub-contracting will result in some **fixed cost savings**.

	W	X	Y	Z
	\$	\$	\$	\$
Unit variable cost of making	14	17	7	12
Unit variable cost of buying	12	21	10	14
	<u>(2)</u>	<u>4</u>	<u>3</u>	<u>2</u>
Annual requirements (units)	1,000	2,000	4,000	3,000
	\$	\$	\$	\$
Extra variable cost of buying (per annum)	(2,000)	8,000	12,000	6,000
Fixed costs saved by buying	<u>(1,000)</u>	<u>(5,000)</u>	<u>(6,000)</u>	<u>(8,000)</u>
Extra total cost of buying	<u>(3,000)</u>	<u>3,000</u>	<u>6,000</u>	<u>(2,000)</u>

- (b) The company would save \$3,000 pa by sub-contracting component W (where the purchase cost would be less than the marginal cost per unit to make internally) and would save \$2,000 pa by sub-contracting component Z (because of the saving in fixed costs of \$8,000).
- (c) In this example, relevant costs are the variable costs of in-house manufacture, the variable costs of sub-contracted units, and the saving in fixed costs.
- (d) **Further considerations**
- If components W and Z are sub-contracted, the company will have **spare capacity**. How should that spare capacity be profitably used? Are there hidden benefits to be obtained from sub-contracting? Would the company's workforce resent the loss of work to an outside sub-contractor, and might such a decision cause an industrial dispute?
 - Would the sub-contractor be **reliable** with delivery times, and would he supply components of the same **quality** as those manufactured internally?
 - Does the company wish to be **flexible** and maintain better **control** over operations by making everything itself?
 - Are the **estimates** of fixed cost savings reliable? In the case of Product W, buying is clearly cheaper than making in-house. In the case of product Z, the decision to buy rather than make would only be financially beneficial if it is feasible that the fixed cost savings of \$8,000 will really be 'delivered' by management. All too often in practice, promised savings fail to materialise!

3 Outsourcing

12/07, 6/12

FAST FORWARD

The relevant costs/revenues in decisions relating to the **operating of internal service departments or the use of external services** are the differential costs between the two options.

3.1 The trend in outsourcing

A significant trend in the 1990s was for companies and government bodies to **concentrate on their core competences** – what they are really good at (or set up to achieve) – and turn other functions over to **specialist contractors**. A company that earns its profits from, say, manufacturing bicycles, does not also need to have expertise in, say, mass catering or office cleaning. **Facilities management** companies such as Rentokil have grown in response to this.

Key term

Outsourcing is the use of external suppliers for finished products, components or services. This is also known as **contract manufacturing** or **sub-contracting**.

Reasons for this trend include:

- (a) Frequently the decision is made on the grounds that **specialist contractors** can offer **superior quality and efficiency**. If a contractor's main business is making a specific component it can invest in the specialist machinery and labour and knowledge skills needed to make that component. However, this component may be only one of many needed by the contractor's customer, and the

complexity of components is now such that attempting to keep internal facilities up to the standard of specialists detracts from the main business of the customer.

- (b) Contracting out manufacturing **frees capital** that can then be invested in core activities such as market research, product definition, product planning, marketing and sales.
- (c) **Contractors** have the **capacity and flexibility** to start production very quickly to meet sudden **variations in demand**. In-house facilities may not be able to respond as quickly, because of the need to redirect resources from elsewhere.

3.2 Internal and external services

In administrative and support functions, too, companies are increasingly likely to use specialist companies. Decisions such as the following are now common.

- (a) Whether the **design and development of a new computer system** should be entrusted to in-house data processing staff or whether an external software house should be hired to do the work.
- (b) Whether **maintenance and repairs** of certain items of equipment should be dealt with by in-house engineers, or whether a maintenance contract should be made with a specialist organisation.

Even if you are not aware of specialist 'facilities management' companies such as Securicor, you will be familiar with the idea of office cleaning being done by contractors.

The costs **relevant** to such decisions are little different to those that are taken into account in a 'conventional' make or buy situation: they will be the **differential costs** between performing the service internally or using an external provider.

Exam focus point

The major problem in examination questions is likely to be identifying whether existing staff will be made redundant or whether they will be redeployed, and whether there are alternative uses for the other resources made available by ceasing to perform the service internally. These, it hardly needs stating, are also likely to be the major problems in practice.

3.3 Performance of outsourcers

*performance of make ?
transfer pricing*

Once a decision has been made to outsource, it is essential that the **performance** of the outsourcer is monitored and **measured**.

Measures could include cost savings, service improvement and employee satisfaction. It is important to have **realistic goals** and expectations and to have **objective ways** to measure success.

The performance of the outsourcer, whether good or bad, can interfere with the performance assessment of an **internal function**. For example:

- Maintenance of equipment could be carried out badly by an outsourcer and this may result in increased breakdowns and reduced labour efficiency of a production team
- If information arrives late or is incorrect, the wrong decision may be made

3.4 Example: Outsourcing

Stunnaz is considering a proposal to use the services of a press cuttings agency. At the moment, press cuttings are collected by a junior member of the marketing department, who is also responsible for office administration (including filing), travel bookings, a small amount of proof reading and making the tea. The total annual cost of employing this person is \$15,000 pa.

There is concern that the ability of this person to produce a comprehensive file of cuttings is limited by the time available. She has calculated that she needs to spend about two hours of her seven and a half hour day simply reading the national and trade press, but usually only has about five hours a week for this job.

Press subscriptions currently cost \$850 pa and are paid annually in advance.

The assistant makes use of a small micro-fiche device for storing cuttings. The cuttings are sent to a specialist firm once a month to be put onto fiche. Stunnaz pays \$45 each month for this service. The micro-fiche reader is leased at a cost of \$76 per calendar month. This lease has another 27 months to run.

The cuttings service bureau has proposed an annual contract at a cost of \$1,250. Several existing users have confirmed their satisfaction with the service they receive.

Should Stunnaz outsource its press cuttings work?

Solution

Current annual costs amount to:

	\$
Micro fiche service	\$45 × 12 = 540
Subscriptions	850
	<u>1,390</u>

The monthly leasing charge is a **committed cost** that must be paid whatever the decision. It is not therefore a decision-relevant cost.

Engaging the services of the press cuttings agency therefore has the *potential* to save Stunnaz \$140 pa. However, this is not the final word: there are other considerations.

- The '**in-house**' option should give management **more direct control** over the work, but the '**outsource**' option often has the benefit that the external organisation has a **specialist skill and expertise** in the work. Decisions should certainly not be based exclusively on cost considerations.
- Will outsourcing create **spare capacity**? How should that spare capacity be profitably used?
- Are there **hidden benefits** to be obtained from subcontracting?
- Would the company's workforce resent the loss of work to an outside subcontractor, and might such a decision cause an **industrial dispute**?
- Would the subcontractor be **reliable with delivery times and quality**?
- Does the company wish to be **flexible** and **maintain better control** over operations by doing everything itself?

4 Further processing decisions

12/07

FAST FORWARD

A joint product should be **processed further** past the split-off point if sales value minus post-separation (further processing) costs is greater than sales value at split-off point.

4.1 Joint products

You will have covered joint products in your earlier studies and the following will act as a brief reminder.

Knowledge brought forward from earlier studies

- Joint products** are two or more products which are output from the same processing operation, but which are indistinguishable from each other up to their point of separation.
- Joint products have a **substantial sales value**. Often they require further processing before they are ready for sale. Joint products arise, for example, in the oil refining industry where diesel fuel, petrol, paraffin and lubricants are all produced from the same process.
- A joint product is regarded as an important saleable item, and so it should be **separately costed**. The profitability of each joint product should be assessed in the cost accounts.
- The point at which joint products become separately identifiable is known as the **split-off point** or **separation point**.

- Costs incurred prior to this point of separation are **common or joint costs**, and these need to be allocated (apportioned) in some manner to each of the joint products.
- Problems in **accounting** for joint products are basically of two different sorts.
 - (a) How common costs should be apportioned between products, in order to put a value to closing inventory and to the cost of sale (and profit) for each product.
 - (b) Whether it is more profitable to sell a joint product at one stage of processing, or to process the product further and sell it at a later stage.

Suppose a manufacturing company carries out process operations in which two or more joint products are made from a common process. If the joint products can be sold either in their existing condition at the 'split-off' point at the end of common processing or after further separate processing, **a decision should be taken about whether to sell each joint product at the split-off point or after further processing.**

Attention!

Note that **joint (pre-separation) costs** are incurred regardless of the decision and are therefore **irrelevant**.

4.2 Example: Further processing

The Poison Chemical Company produces two joint products, Alash and Pottum from the same process. Joint processing costs of \$150,000 are incurred up to split-off point, when 100,000 units of Alash and 50,000 units of Pottum are produced. The selling prices at split-off point are \$1.25 per unit for Alash and \$2.00 per unit for Pottum.

The units of Alash could be processed further to produce 60,000 units of a new chemical, Alashplus, but at an extra fixed cost of \$20,000 and variable cost of 30c per unit of input. The selling price of Alashplus would be \$3.25 per unit. Should the company sell Alash or Alashplus?

Solution

The only relevant costs/incomes are those which compare selling Alash against selling Alashplus. Every other cost is irrelevant: they will be incurred regardless of what the decision is.

	<i>Alash</i>		<i>Alashplus</i>	
Selling price per unit	\$1.25		\$3.25	
	\$		\$	\$
Total sales	125,000		195,000	
Post-separation processing costs	–	Fixed	20,000	
	–	Variable	30,000	50,000
Sales minus post-separation (further processing) costs	<u>125,000</u>		<u>145,000</u>	

It is \$20,000 more profitable to convert Alash into Alashplus.



Question

Further processing decision

A company manufactures four products from an input of a raw material to Process 1. Following this process, product A is processed in Process 2, product B in Process 3, product C in Process 4 and product D in Process 5.

The normal loss in Process 1 is 10% of input, and there are no expected losses in the other processes. Scrap value in Process 1 is \$0.50 per litre. The costs incurred in Process 1 are apportioned to each product according to the volume of output of each product. Production overhead is absorbed as a percentage of direct wages.

Data in respect of the month of October

	Process					Total
	1	2	3	4	5	
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Direct materials at \$1.25 per litre	100					100
Direct wages	48	12	8	4	16	88
Production overhead						66

	Product			
	A	B	C	D
	litres	litres	litres	litres
Output	22,000	20,000	10,000	18,000
	\$	\$	\$	\$
Selling price	4.00	3.00	2.00	5.00
Estimated sales value at end of Process 1	2.50	2.80	1.20	3.00

Required

Suggest and evaluate an alternative production strategy which would optimise profit for the month. It should not be assumed that the output of Process 1 can be changed.

Answer

During the month, the quantity of input to Process 1 was 80,000 litres. Normal loss is 10% = 8,000 litres, and so total output should have been 72,000 litres of A, B, C and D. Instead, it was only 70,000 litres. In an 'average' month, output would have been higher, and this might have some bearing on the optimal production and selling strategy.

The **central question** is whether or not the output from Process 1 should be **processed further** in processes 2, 3, 4 and 5, or whether it should be **sold at the 'split-off' point**, at the end of Process 1. Each joint product can be looked at **individually**.

A further question is whether the **wages costs** in process 2, 3, 4 and 5 would be avoided if the joint products were sold at the end of process 1 and not processed further. It will be assumed that all the wages costs would be **avoidable**, but none of the **production overhead** costs would be. This assumption can be challenged, and in practice would have to be investigated.

	A	B	C	D
	\$	\$	\$	\$
Selling price, per litre	4.00	3.00	2.00	5.00
Selling price at end of process 1	2.50	2.80	1.20	3.00
Incremental selling price, per litre	<u>1.50</u>	<u>0.20</u>	<u>0.80</u>	<u>2.00</u>
Litres output	22,000	20,000	10,000	18,000
	\$'000	\$'000	\$'000	\$'000
Total incremental revenue from further processing	33	4	8	36
Avoidable costs from selling at split-off point (wages saved)	12	8	4	16
Incremental benefit/(cost) of further processing	<u>21</u>	<u>(4)</u>	<u>4</u>	<u>20</u>

This analysis would seem to indicate that **products A, C and D should be further processed** in processes 2, 4 and 5 respectively, but that **product B should be sold at the end of process 1**, without further processing in process 3. The saving would be at least \$4,000 per month.

If **some production overhead** (which is 75% of direct wages) were also **avoidable**, this would mean that:

- Selling product B at the end of process 1 would offer further savings of up to (75% of \$8,000) \$6,000 in overheads, and so \$10,000 in total.
- The incremental benefit from further processing product C might fall by up to (75% of \$4,000) \$3,000 to \$1,000, meaning that it is only just profitable to process C beyond the split-off point.

Shutdown/discontinuance problems can be simplified into short-run relevant cost decisions.

5.1 Simplifying decisions

Discontinuance or shutdown problems involve the following decisions.

- (a) **Whether or not to close down** a product line, department or other activity, either because it is making losses or because it is too expensive to run
- (b) If the decision is to shut down, **whether the closure should be permanent or temporary**



In practice, shutdown decisions may often involve **longer-term considerations**, and **capital expenditures and revenues**.

- (a) A shutdown should result in savings in **annual operating costs** for a number of years into the future.
- (b) Closure will probably release **unwanted non-current assets for sale**. Some assets might have a small scrap value, but other assets, in particular property, might have a substantial sale value.
- (c) **Employees** affected by the closure must be made **redundant** or relocated, perhaps after retraining, or else offered early retirement. There will be lump sum payments involved which must be taken into account in the financial arithmetic. For example, suppose that the closure of a regional office would result in annual savings of \$100,000, non-current assets could be sold off to earn income of \$2 million, but redundancy payments would be \$3 million. The shutdown decision would involve an assessment of the net capital cost of closure (\$1 million) against the annual benefits (\$100,000 pa).

It is possible, however, for shutdown problems to be **simplified into short-run decisions**, by making one of the following assumptions.

- (a) Non-current asset sales and redundancy costs would be negligible.
- (b) Income from non-current asset sales would match redundancy costs and so these capital items would be self-cancelling.

In such circumstances the financial aspect of shutdown decisions would be based on **short-run relevant costs**.

5.2 Example: Adding or deleting products (or departments)

A company manufactures three products, Pawns, Rooks and Bishops. The present net annual income from these is as follows.

	<i>Pawns</i>	<i>Rooks</i>	<i>Bishops</i>	<i>Total</i>
	\$	\$	\$	\$
Sales	50,000	40,000	60,000	150,000
Variable costs	30,000	25,000	35,000	90,000
Contribution	20,000	15,000	25,000	60,000
Fixed costs	17,000	18,000	20,000	55,000
Profit/loss	3,000	(3,000)	5,000	5,000

The company is concerned about its poor profit performance, and is considering whether or not to cease selling Rooks. It is felt that selling prices cannot be raised or lowered without adversely affecting net income. \$5,000 of the fixed costs of Rooks are direct fixed costs which would be saved if production ceased (ie there are some attributable fixed costs). All other fixed costs, it is considered, would remain the same.

By **stopping production of Rooks**, the **consequences** would be a \$10,000 fall in profits.

	\$
Loss of contribution	(15,000)
Savings in fixed costs	5,000
Incremental loss	<u>(10,000)</u>

Suppose, however, it were possible to use the resources realised by stopping production of Rooks and **switch to producing a new item**, Crowners, which would sell for \$50,000 and incur variable costs of \$30,000 and extra direct fixed costs of \$6,000. A new decision is now required.

	<i>Rooks</i>	<i>Crowners</i>
	\$	\$
Sales	40,000	50,000
Less variable costs	<u>25,000</u>	<u>30,000</u>
	15,000	20,000
Less direct fixed costs	<u>5,000</u>	<u>6,000</u>
Contribution to shared fixed costs and profit	<u>10,000</u>	<u>14,000</u>

It would be **more profitable to shut down production of Rooks and switch** resources to making Crowners, in order to boost profits by \$4,000 to \$9,000.



5.3 Timing of shutdown

An organisation may also need to consider the most appropriate timing for a shutdown. Some costs may be avoidable in the long run but not in the short run. For example, office space may have been rented and three months notice is required. This cost is therefore **unavoidable** for three months. In the same way supply contracts may require notice of cancellation. A month by month analysis of when notice should be given and savings will be made will help the decision making process.

5.4 Qualitative factors

As usual the decision is not merely a matter of choosing the best financial option. **Qualitative** factors must once more be considered.

- (a) What impact will a shutdown decision have on employee morale? *stakeholders*
- (b) What signal will the decision give to competitors? How will they react?
- (c) How will customers react? Will they lose confidence in the company's products?
- (d) How will suppliers be affected? If one supplier suffers disproportionately there may be a loss of goodwill and damage to future relations.



Question

Shutdown decisions

How would the above decision change if Pawns, Rooks and Bishops were manufactured in different departments, variable costs could be split down into the costs of direct materials, labour and overheads, and fixed costs could be analysed into the costs of administrative staff and equipment and premises costs?

Answer

The decision would not change at all – unless perhaps activity based analysis of overheads were undertaken and unexpected cost patterns were revealed. The point of this exercise is to make you realise that problems that look complicated are sometimes very simple in essence even if the volume of calculations seems daunting.

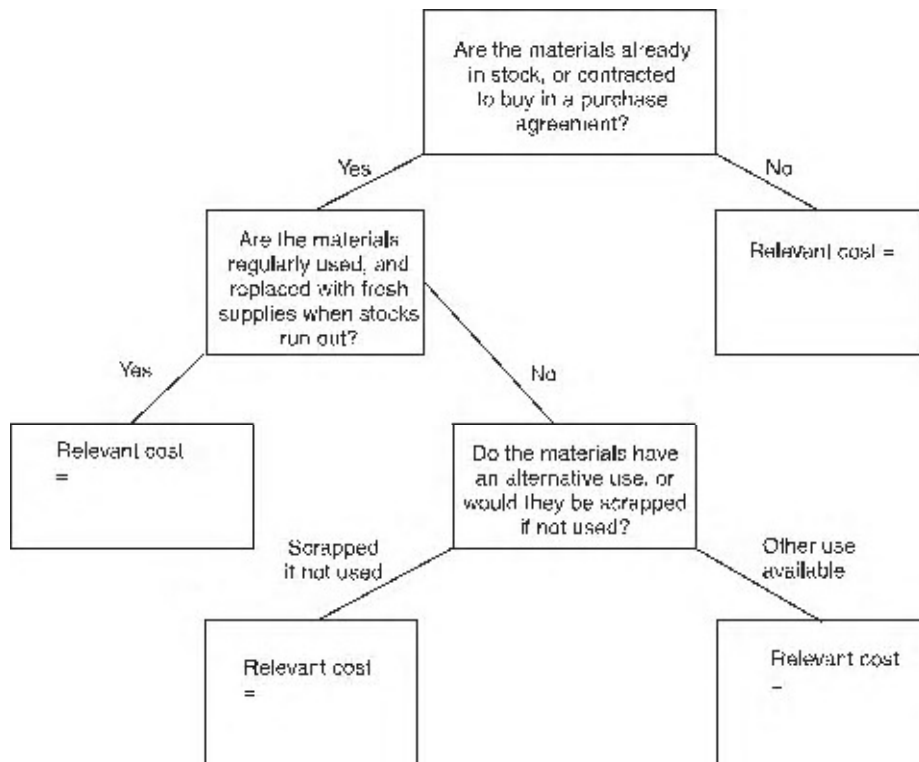
5.5 Judging relative profitability

A common approach to judging the relative profitability of products is to calculate **C/S ratios**. The most profitable option is to concentrate on the product(s) with the highest C/S ratios.

Chapter Roundup

- **Relevant costs** are future cash flows arising as a direct consequence of a decision.
 - Relevant costs are **future costs**
 - Relevant costs are **incremental costs**
 - Relevant costs are **cash flows**
- In a **make or buy decision** with no limiting factors, the relevant costs are the differential costs between the two options.
- The relevant costs/revenues in decisions relating to the **operating of internal service departments or the use of external services** are the differential costs between the two options.
- A joint product should be **processed further** past the split-off point if sales value minus post-separation (further processing) costs is greater than sales value at split-off point.
- **Shutdown/discontinuance problems** can be simplified into short-run relevant cost decisions.

1 Fill in the relevant costs in the four boxes in the diagram below.



2 Choose the correct word(s) from those highlighted.

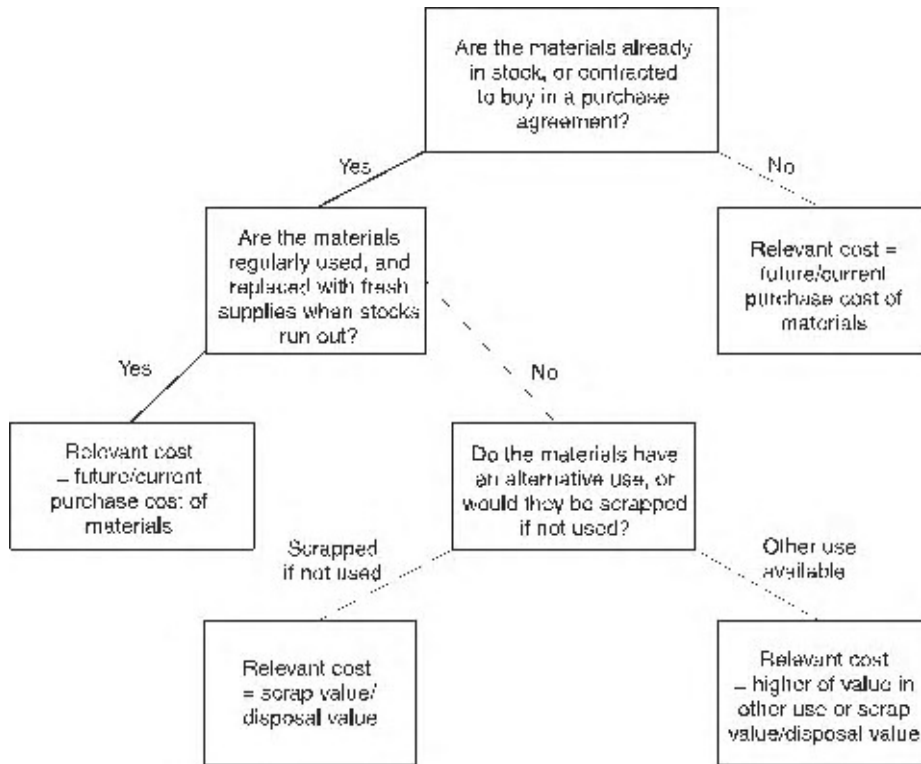
In a situation where a company must subcontract work to make up a shortfall in its own in-house capabilities, its total cost will be minimised if those units **bought out from a sub-contractor/made in-house** have the **lowest/highest** extra **variable/fixed** cost of **buying out/making in-house** per unit of **scarce resource/material**.

3 In a decision about whether or not to sell a joint product at the split-off point or after further processing, joint costs are relevant. **True or false?**

4 *Fill in the blanks.*

Most of the decisions considered in this chapter involve calculating obtained from various options after identifying They always involve issues, which depend upon the precise situation described.

1



2 bought out from a subcontractor
lowest
variable

buying out
scarce resource

3 False

4 contribution
relevant costs
qualitative

Now try the question below from the Exam Question Bank

Number	Level	Marks	Time
Q10	Examination	20	36 mins