

Chapter 8 Short-term decisions

企业一般会面临各种各样的短期决策，比如内部生产还是外包，是否深加工，是否关闭生产线的生产等等。但是所有的决策都要基于相关成本的信息。什么是相关成本，与传统成本有什么区别呢？怎么计算相关成本呢？就是本章的重点。

Learning outcomes

- Explain the concept of relevant costing.
- Identify and calculate relevant costs for specific decision situations from given data.
- Calculate and compare “make” costs with “buy-in” costs.
- Apply relevant costing principles in situations involving shut down and the further processing of joint products.

1. Identify relevant costs

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

- Relevant costs are future costs.
- Relevant costs are cash flows.
- Relevant costs are incremental costs, arising as a direct consequence of the decision.

Relevant costs – examples:

- Opportunity costs – The value of the benefit sacrificed when one course of action is chosen, in preference to an alternative
- Avoidance costs – the specific costs of an activity which would be avoided if that activity did not exist.
- Directly attributable fixed cost

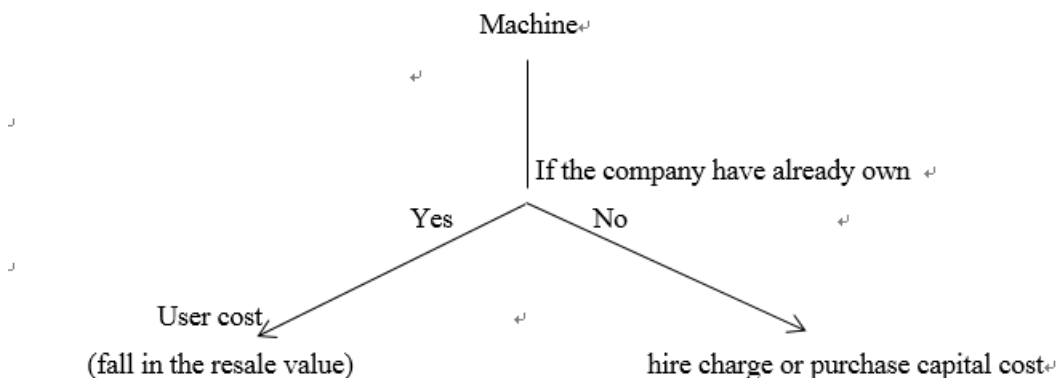
Irrelevant costs – examples:

- Sunk costs – costs have already been incurred.

- Committed costs – although future and cash flows, they are not incremental.
- General Fixed costs
- Depreciation—is not a cash flow but a method of accounting for past capital expenditure.
- Notional costs – non-cash items.

1.2 Relevant costs for one-off contract

1.2.1 Relevant costs for machine



Example 1 Fall in Realisable Value

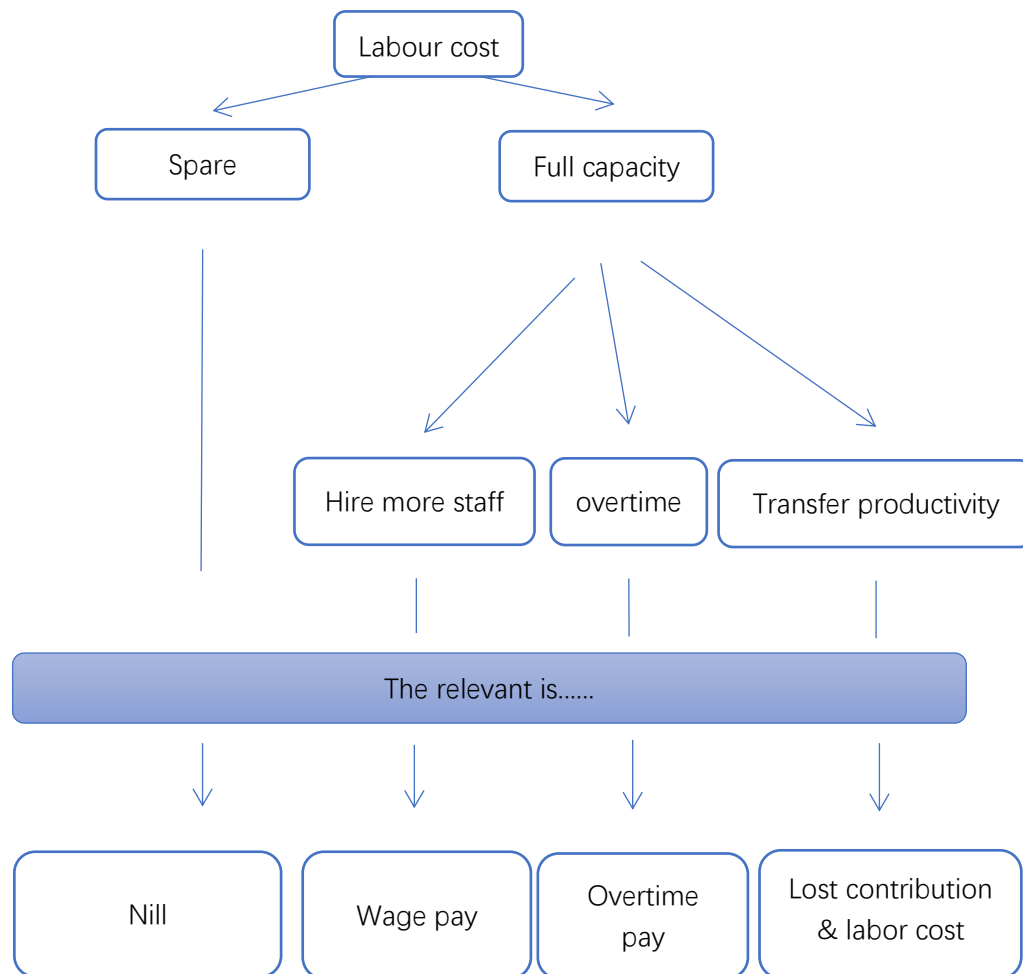
Bob, a builder, owns a crane. He believes that he could sell it today for \$150,000 in the used-crane market.

He is tendering for a contract to renovate the town hall, which is expected to take a year to complete. If he wins this contract he will need to keep the crane. Once the town hall contract is complete he would sell the crane. He estimates that he would be able to sell it for \$120,000 in one year's time.

If he does not win the town hall contract, he will sell the crane straight away for \$150,000.

For the town hall contract, the relevant cost of the crane is \$30,000. This is the fall in the realisable value of the crane if it is used on this contract.

1.2.2 Relevant cost of labour



Example 2 Labour

Magnolia Co has a new project which requires the following three types of labour:

	Hours	Additional information
Unskilled	12,000	Paid \$8 per hour and existing staff are fully utilised. New staff must be hired to meet this additional demand.
Semi-skilled	2,000	Paid \$12 per hour. As these employees are difficult to recruit, Magnolia retains some permanently employed staff, even if there is no work to do. There are 800 hours of idle time currently available. Any additional hours would be fulfilled by temporary staff that would be paid at \$14/hour.

Example 2 Labour

Skilled	8,000	Paid \$15 per hour. As there is a severe shortage of skilled employees, Magnolia would have to move skilled employees from the manufacture of Product X in order to undertake the project. Each unit of Product X requires 4 hours of labour and generates a contribution of \$24/unit.
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Relevant costs

Unskilled – the incremental cash outflow incurred in hiring the new staff necessary for the project is \$96,000 (12,000 hours × \$8).

Semi-skilled – Of the 2,000 hours needed, 800 are already available and already being paid. There is no incremental cost of using spare capacity on the new project. The relevant cost is therefore only for hiring temporary staff which is \$16,800 (1,200 hours × \$14).

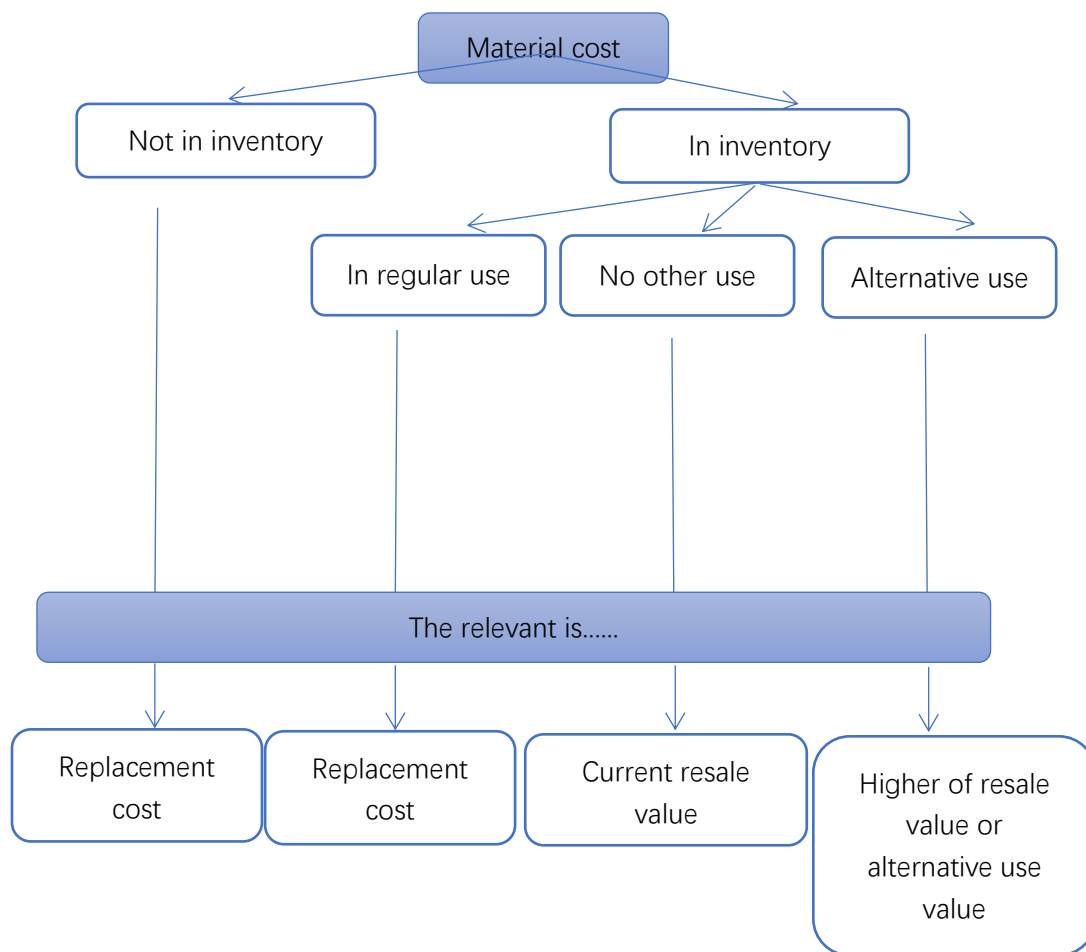
Skilled – Consider the calculation of unit contribution for Product X:

Revenue	x
Materials	x
Labour (4 × 15)	60
Variable overheads	x
Contribution	24

For each unit of X that cannot be produced, Magnolia will lose the revenue but save material and variable overhead costs. Although revenue, material and variable overhead are not known, their net amount must be \$84 a unit (60 + 24) or \$21 per skilled labour hour (\$84/4).

This is usually calculated as \$15 (current labour cost per hour) plus \$6 (lost contribution per hour, \$24/4). The relevant cost of skilled labour is therefore \$168,000 (8,000 × (\$15 + \$6)).

1.2.3 Relevant cost of materials



Example 3:

O'Reilly Co has been approached by a customer who would like a special job to be done for them, 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	Realizable value	Replacement costs
			\$/unit	\$/unit	\$/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

(a) 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.

(b) Materials C and D are in inventory as the result of previous overbuying, 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).

Required:

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

Solution:

(a) Material A: this is not owned and would have to be bought in full at the replacement cost of \$6 per unit.

(b) Material B: this 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.

(c) 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 realizable value of these 700 units is an opportunity cost of sales revenue forgone.

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

2.Short term decisions

Relevant costs are used when a decision has to be taken .

Types of short term decision

- ❖ Make or buy decisions
- ❖ Further processing decisions
- ❖ Shutdown decision

2.1 Make or buy decision

In a make or buy decision, the choice is between making items in-house or purchasing them from an external supplier. When there are **no limiting factors restricting** the in-house production capacity, the relevant costs are the **differential costs between the two options**.

Example 4: 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
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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	<u>2</u>	<u>3</u>	<u>1</u>	<u>2</u>
	<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)	<u>30,000</u>
	<u>50,000</u>

Directly attributable fixed costs are all items of cash expenditure that are incurred as a direct consequence of making the product in-house.

A subcontractor has offered to supply units of W, X, Y and Z for \$12, \$21, \$10 and \$14 respectively

Required:

Should Shellfish make or buy the components?

Solution

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.

Subcontracting will result in some fixed cost savings.

	W	X	Y	Z
	\$	\$	\$	\$
Unit variable cost of buying	12	21	10	14
Unit variable cost of making	<u>14</u>	<u>17</u>	<u>7</u>	<u>12</u>
	<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	(3,000)	3,000	6,000	(2,000)

The company would save \$3,000 pa by subcontracting 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 subcontracting component Z (because of the saving in fixed costs of \$8,000).

2.1.1 Advantage&Disadvantage of buying

Advantages of Outsourcing

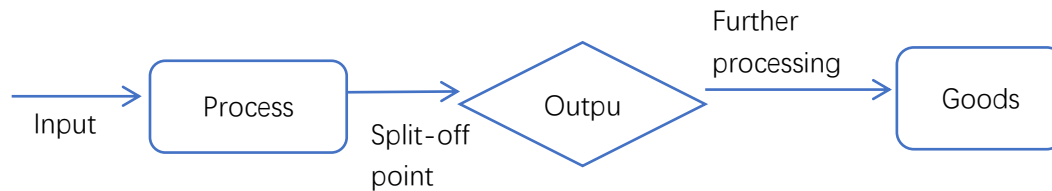
- **Lower cost.** Many companies have discovered that some goods or services may be purchased for less than it would cost to provide them internally.
- Outsourcing allows management to focus on the **core competencies** of the business without being distracted by managing peripheral areas.
- **Better quality** of the goods or service provided by a specialist third party.
- Access to a wider range of **expertise** as the provider deals with several clients.

Disadvantages of Outsourcing

- **The company relies on a third party to provide a reliable supply. It therefore loses control over a part of its business processes.**
- **Outsourcing may mean trusting a third party with confidential information about goods or services.**
- **Quality may suffer especially if the contract price per unit is fixed (i.e. the third party can only increase its profit by reducing costs).**
- **Operational dependence on the outsourcing company is linked to its financial stability. If the third-party company fails, switching to another provider may be very costly.**
- **Outsourcing may demotivate the workforce if the decision to outsource is associated with job losses.**

2.2 Further processing decisions

A further processing decision is whether to sell the products at the split-off point, as soon as they emerge from the common process, or whether they should be processed further before selling them.



Example 5: Further processing decision

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 the split-off point, when 100,000 units of Alash and 50,000 units of Pottum are produced. The selling prices at the 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.

Required:

Should the company sell Alash or Alashplus?

Solution:

The only relevant costs/incomes are those which compare the sale of Alash against the sale of Alashplus.

Every other cost is irrelevant: they will be incurred regardless of what the decision is.

	\$	\$
Sales for Alashplus 60,000×3.25	195,000	

Sales for Alash $100,000 \times 1.25$	<u>125,000</u>	
Incremental sales		70,000
Extra fixed cost	(20,000)	
Extra variable cost $100,000 \times 0.3$	<u>(30,000)</u>	
Incremental cost		<u>(50,000)</u>
Incremental profit		20,000

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

2.3 Shutdown decisions

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

A shutdown decision is whether to close down an operation or stop making and selling a particular product or service.

Example 6 Shut-down Decision

Rolling Co is composed of four divisions: North, South, East and West. The directors are concerned about the performance of East and West divisions, which have consistently shown losses for the last three years.

The divisional statements of profit or loss for the last year show the following:

	North	South	East	West
	\$	\$	\$	\$
Sales	5,000	10,000	7,500	6,000
Variable costs	2,500	4,000	4,000	3,000
Contribution	2,500	6,000	3,500	3,000
Fixed costs	1,500	3,500	4,000	3,200
Profits/(losses)	1,000	2,500	(500)	(200)

Further analysis of the fixed costs reveals the following:

	\$	\$	\$	\$
Directly attributable	500	1,500	2,500	2,000
Allocated (20% of revenue)	1,000	2,000	1,500	1,200

	\$	\$	\$	\$
Total fixed costs	1,500	3,500	4,000	3,200

Assumed that directly attributable fixed costs would be saved if the division were closed down.

Required:

Calculate the financial impact on Rolling Co of closing divisions East and West. Based on your calculations, advise the management whether the divisions should be closed.

Solution:

	East	West
	\$	\$
Lost contribution	(3,500)	(3,000)
Saved fixed costs (attributable only)	2,500	2,000
Net savings/(losses)	(1,000)	(1,000)

Conclusion

Closing each division would lead to a reduction in profits of \$1,000 per year. They should not be closed. The two divisions make a positive contribution to the company's overall profits and only show a loss because of allocation of central fixed costs.

2.3.1 Qualitative factors

With shutdown decisions, as with many other decisions involving relevant costs, the decision is not merely a matter of choosing the best financial option. Qualitative factors may be significant and may influence the financial decision.

For example:

- If closing a division would result in redundancies, this could lead to poor morale among remaining employees.
- The permanent loss of resources and specific skills may mean that it will not be possible to take advantage of future opportunities.
- Shutting down one division may affect demand for products produced by other divisions (e.g. if customers like to buy a range of products from one supplier, closing a particular division will limit the range that is available).

- It may be possible to bring a loss-making division back to profitability by developing new products or services.
- Shutting down a division may make it possible to sell assets such as buildings to raise finance for other divisions or to reduce debt.

Chapter 9 Risk and uncertainty

在一个理想的世界里，决策者应该清楚地知道他们所面临的每一个选择的未来后果。但在现实世界中，决策对应的结果充满不确定性。所以将风险和不确定性纳入决策是非常重要的。本章主要研究针对风险和不确定性的各种决策方法。

Learning outcomes

- Explain the risk preference.
- Apply the techniques of maximax, maximin, and minimax regret to decision-making problems.
- Apply expected values and sensitivity to decision-making problems.
- Interpret a decision tree and use it to solve a multi-stage decision problem.
- Calculate the value of perfect and imperfect information.

1. Risk and uncertainty

1.1 Definition

Risk involves situations or events which may or may not occur, but whose probability of occurrence can be estimated statistically.

Uncertain events are events where the outcome cannot be estimated with a statistical probability.

1.2 Research techniques to reduce uncertainty

Market research: is the systematic process of gathering, analyzing and reporting data about markets to investigate, describe, measure, understand or explain a situation or problem facing a company or organization.

Focus groups: a focus may be to obtain **qualitative views and opinions** from a small group of individual.

1.3 Risk preference

People may be **risk seekers**, **risk neutral** or **risk averse**. A person's attitude to risk and uncertainty may affect the decision that is taken.

A **risk seeker** is a decision-maker who is interested in the best outcomes, no matter how small the chance that they may occur.

A **risk-averse** decision-maker acts on the assumption that the worst outcome might occur and will make a decision that limits or minimize the risk.

A decision-maker is **risk neutral** if they are prepared to make a decision that balances risk and return.

2. Probabilities and expected values

2.1 Expected values

It is a useful method for **risk neutral** decision maker

Formula: $EV = \sum px$

Where 'p' is the probability of the outcome

'x' is the value of the outcome

Example 1: Expected values

Suppose a manager has to choose between mutually exclusive options A and B, and the probable outcomes of each option are as follows.

Option A		Option B	
Probability	Profit	Probability	Profit
	\$		\$
0.8	5,000	0.1	(2,000)
0.2	6,000	0.2	5,000
		0.6	7,000
		0.1	8,000

The expected value (EV) of profit of each option would be measured as follows.

Option A			Option B		
Prob	Profit	EV of profit	Prob	Profit	EV of profit
p	x	px	p	x	px
	\$	\$		\$	\$
0.8	x 5,000	= 4,000	0.1	x (2,000)	= (200)
0.2	x 6,000	= <u>1,200</u>	0.2	x 5,000	= 1,000
	EV =	5,200	0.6	x 7,000	= 4,200
			0.1	x 8,000	= <u>800</u>
				EV =	5,800

In this example, since it offers a higher EV of profit, option B would be selected in preference to A, unless further risk analysis is carried out.

2.2 Limitations of the expected value

- (a) The probabilities of the different possible outcomes may be difficult to estimate.
- (b) The average may not correspond to any of the possible outcomes.
- (c) Unless the same decision has to be made many times, the average will not be achieved; it is therefore unsuitable for decision making in “one-off ” situations.
- (d) The average gives no indication of the spread of possible results (i.e. it ignores risk).

3. Other decision rules

- Maximin decision rules
- Maximax decision rules
- Minimax regret decision rules

3.1 Maximin decision rule

Select the alternative with the **highest return under the worst-case scenario**. The pessimist's rule (i.e. risk averse).

Example 2: Suppose a businessman is trying to decide which of three **mutually exclusive** projects to undertake. Since they are mutually exclusive, only one of the projects can be selected. Each of the projects could lead to varying net profit under three possible scenarios or outcomes. (The figures in the pay-off table are figures for profit, in \$'000.)

Pay-off table		Project choice		
		<i>D</i>	<i>E</i>	<i>F</i>
Scenarios	I	100	80	60
	II	90	120	85
	III	(20)	10	85
Worst possible		(20)	10	60

The best worst outcome is 60 and project F would therefore be selected (because this is a better 'worst possible' than either D or E).

3.2 Maximax decision rule

Select the alternative with the maximum possible payoff (i.e. highest return under the best-case scenario). The risk seeker's (i.e. optimist's) rule.

Pay-off table		Supply		
		<i>D</i>	<i>E</i>	<i>F</i>
Demand	I	100	80	60
	II	90	120	85
	III	(20)	10	85
		<i>D</i>	<i>E</i>	<i>F</i>
		\$	\$	\$
maximum profit		100	120	85

Project E would be chosen if the maximax rule is followed, because it offers the prospect of the biggest profit.

3.3 Minimax regret rule

Select the alternative with the **lowest maximum regret**. Regret is defined as the **opportunity loss from having made the wrong decision**. Minimax regret is also suited to investors that are adverse to missing out.

Using the Example 2 in Section 3.1, a table of regrets can be compiled as follows

The pay-off table (in \$'000) is as follows.

Pay-off table		Project choice		
		<i>D</i>	<i>E</i>	<i>F</i>
Scenarios	I	100	80	60
	II	90	120	85
	III	(20)	10	85

The regret for each decision option in each outcome situation is shown in the pay-off table below.

		Project option		
		<i>D</i>	<i>E</i>	<i>F</i>
Scenario/outcome situation	I *	0	20	40
	II **	30	0	35
	III ***	105	75	0
Maximum regret		105	75	40

The **lowest** of maximum regrets is 40 with Option F so Option F would be selected, if the minimax regret rule is used as the basis for making the decision.

Exercise

1. A company is considering which one of three alternative courses of action, A, B and C, to take. The profit or loss from each choice depends on which one of four economic circumstances, I, II, III or IV, will apply.

The possible profits and losses, in thousands of pounds, are given in the following pay-off table. Losses are shown as negative figures.

		Decision option		
		A	B	C
Circumstance/outcome	I	70	60	70
	II	-10	20	-5
	III	80	0	50
	IV	60	100	115

Required:

State which option would be selected using

- (a) The maximax decision rule
- (b) The maximin decision rule
- (c) The minimax regret

3.4 Pay-off tables

Example 3:worst/best possible outcomes

Omelette Co is trying to set the sales price for one of its products. Three price are under consideration, and expected sales volumes and costs are as follows.

Sales demand	pricing choices		
	\$4	\$4.30	\$4.40
Best possible	16,000	14,000	10,000
Most likely	14,000	12,500	8,000
Worst possible	12,500	12,000	6,000

Fixed costs are \$20,000 and variable costs of sales are \$2 per unit.

Prepare a pay-off table for the different possible outcomes for each decision option.

Solution:

Here we need to prepare a pay-off table showing pay-offs(contribution) dependent on different levels of demand and different selling prices.

In the table below ,there is a column for each of the three possible pricing options, and there is a row for each of the three possible outcomes:best possible,most likely and worst possible.

The table is completed by entering the total contribution(or it could be profit,if you prefer) for each different price,given each possible outcome.the working are not shown here.

Pay-off table			
Price per unit	\$4	\$4.30	\$4.40
Contribution per unit	\$2	\$2.30	\$2.40
Total contribution towards fixed costs	\$	\$	\$
Best possible	32,000	32,200	24,000
Most likely	28,000	28,750	19,200
Worst possible	25,000	27,600	14,400

4. Decision trees

Decision trees is a **pictorial method** of showing a sequence of **interrelated decision and their expected outcomes**. It is most useful when there are several decisions and a range of outcomes.

4.1 Evaluating a decision tree

□ : option

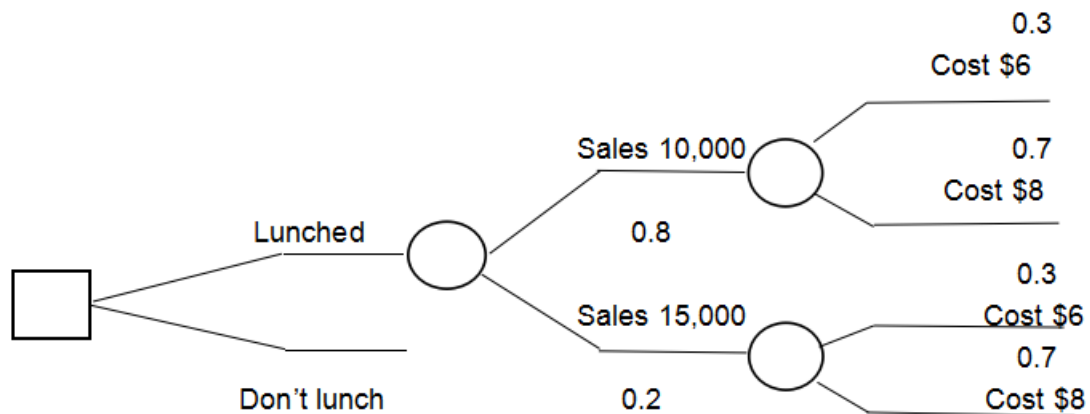
○ : possible outcome

Example 4: Several possible outcomes

A company can choose to launch a new product, XYZ, or not. If the product is launched, expected sales and expected unit costs might be as follows.

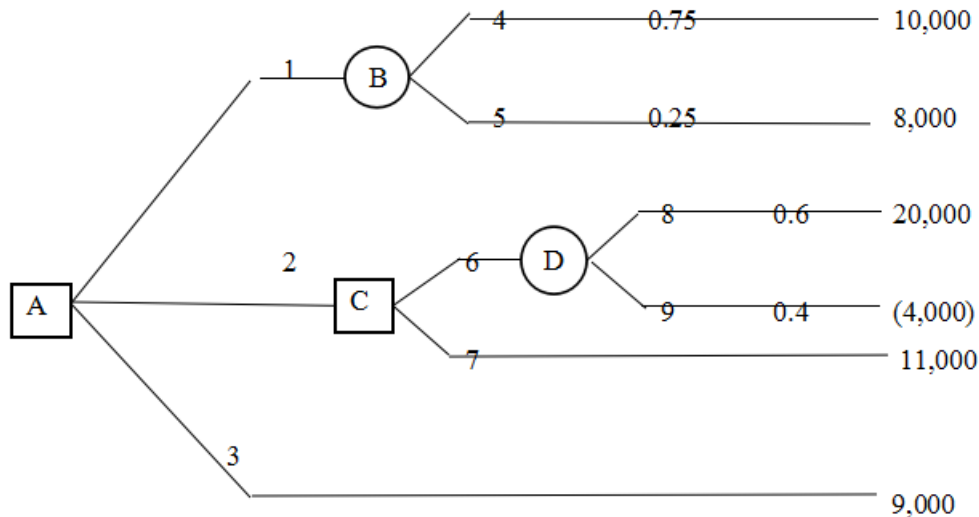
<i>Sales Units</i>	<i>Probability</i>	<i>unit cost£</i>	<i>Probability</i>
10,000	0.8	6	0.7
15,000	0.2	8	0.3

The decision tree could be drawn as follows.



Exercise:

2.Considering the following diagram.



If a decision-maker wished to maximize the value of the outcome, which options should be selected?

- A. Option 2 and option 7
- B. Option 3
- C. Option 1 and option 4
- D. Option 2, option 6 and option 8

5. The value of information

5.1 Value of perfect information

Perfect information is guaranteed to predict the future with 100% accuracy.

The **value of perfect information**

Expected value with perfect/imperfect information	X
Expected value without perfect/imperfect information	<u>(X)</u>
Value of information	X

Information may be either perfect or imperfect.

Example 5: The value of perfect information

The management of Ivor Ore must choose whether to go ahead with either of two **mutually exclusive** projects, A and B. The expected profits are as follows.

<i>Profit if there is strong demand</i>	<i>Profit if there is moderate demand</i>	<i>Profit/loss if there is weak demand</i>
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Option A	\$4,000	\$1,200	\$(1,000)
Option B	\$1,500	\$1,000	\$500
Probability of demand	0.2	0.3	0.5

Required

(a) Ascertain what the decision would be, based on expected values, if no information about demand were available.

(b) Calculate the value of perfect information about demand.

Solution

Step 1 If there is **no information** to help with the decision, the project with the higher EV of profit would be selected.

Probability	Project A		Project B	
	Profit	EV	Profit	EV
	\$	\$	\$	\$
0.2	4,000	800	1,500	300
0.3	1,200	360	1,000	300
0.5	(1,000)	<u>(500)</u>	500	<u>250</u>
		<u>660</u>		<u>850</u>

Project B would be selected and the EV of the decision is + \$850.

Step 2 With perfect information

Forecast demand	Probability	Project chosen	Profit	EV of profit
			\$	\$
Weak	0.5	B	500	250
Moderate	0.3	A	1,200	360
Strong	0.2	A	4,000	<u>800</u>
EV of profit with perfect information				<u>1,410</u>

Step 3	\$
EV of profit with perfect information	1,410
EV of profit without perfect information (ie if project B is always chosen)	<u>(850)</u>
Value of perfect information	<u>560</u>

Provided that the information does not cost more than \$560 to collect, it would be worth having, on the assumption that the EV decision rule is applied.

5.2 Value of Imperfect Information

In the real world, it is unlikely that any forecast would be perfect. Even with an inaccurate forecast, however, the company may make a higher expected return than with no forecast at all.

Value of imperfect information = EV with imperfect information – EV without information

Example 6 Imperfect Information

A news agent has to decide how many newspapers to buy each day. Demand is uncertain and can either be high, with a probability of 60%, or low, with a probability of 40%. A profit table shows the profits for the possible combinations of order size and demand:

		Order Size
		High
Demand	High	1,000
	Low	(200)

EV without information

Without any additional information, the news agent would order the quantity which gives the highest expected profit:

Expected outcome of placing a high order: \$520 $((1,000 \times 0.6) + ((200) \times 0.4))$.

Expected outcome of placing a low order: \$400 $((400 \times 0.6) + ((400) \times 0.4))$.

EV with imperfect information

The news agent can commission a survey which will tell him what demand will be on a particular day. If the survey says demand will be high on a particular day, he will place a high order; if it says demand will be low on a particular day, he will place a low order. There is a 60% chance that the survey will say high and a 40% chance that the survey will say low. The survey is not always correct, and there is a 90% chance that it will be correct.

Example 6 Imperfect Information

If the news agent commissions the survey, the following profits, along with their associated probabilities, would be possible:

	Profit (\$)
Survey says high and is correct	1,000
Survey says high and is incorrect	(200)
Survey says low and is correct	400
Survey says low and is incorrect	400

EV with imperfect information = $(1,000 \times 0.54) + ((200) \times 0.06) + (400 \times 0.36) + (400 \times 0.04) = \688 .

The value of imperfect information in this case is:

	\$
EV with the survey	688
EV without the survey	520
Value of imperfect information	168

6.Sensitivity analysis

Sensitivity analysis measures the effect of changes in the estimated value of an item ('key factor') on the future outcome. Assessing if the decision would change if a variable changed by x% of estimate.

Example 7: Sensitivity analysis

Sensivite Co has estimated the following sales and profits for a new product which it may launch on to the market.

	\$	\$
Sales (2,000 units)		4,000

Variable costs: materials	2,000	
labour	1,000	
		<u>3,000</u>
Contribution		1,000
Less incremental fixed costs		<u>(800)</u>
Profit		200

Required

Analyse the sensitivity of the project to changes in key variables.

Solution

(a) If incremental **fixed costs** are more than 25% above estimate ($= 200/800$), the project would make a loss.

(b) If **unit costs of materials** are more than 10% above estimate ($200/2,000$), the project would make a loss.

(c) Similarly, the project would be sensitive to an **increase in unit labour costs** of more than \$200, which is 20% above estimate.

(d) Moreover, the project would become unprofitable if the selling price is more than 5% ($200/4,000$) below the estimate, given no change in sales volume.

(e) The **margin of safety**, given a break even point of 1,600 units, is $(400/2,000) \times 100\% = 20\%$.

The items to which profitability is most sensitive in this example are the selling price (5%) and material costs (10%). Sensitivity analysis can help to concentrate management attention on the most important factors.

7.Simulation models（仿真模型）

Simulation models can be used to deal with decision problems when there are a large number of uncertain variables in the situation. **Random numbers** are used to assign values to the variables.

Obviously this is a situation **ideally suited to a computer** (large volume of data, random number generation).

Chapter 10 Budgetary systems

本章讨论预算编制制度和编制预算的方法。我们需要灵活掌握传统的预算编制方法：增量预算，以及可供选择的预算编制方法：零基础预算、滚动预算和弹性预算。我们应该意识到传统预算系统的问题，以及为什么组织很多时候确不愿意改变到更合适的系统？

Learning outcomes

- Select and explain appropriate budgetary systems for an organization.
- Indicate the usefulness and problems with different budget types.
- Prepare flexed budgets, rolling budgets and activity-based budgets.
- Explain the difficulties of changing a budgetary system or type of budget used.
- Explain how budget systems can deal with uncertainty in the environment.

1. Budgeting systems

1.1 Introduction

A number of different approaches to the preparation of budgets have evolved. It is important to understand what these approaches are, and to appreciate which would be appropriate for different types of organisations. The approaches mentioned in the ACCA Study Guide are as follows:

- Top-down and bottom-up
- Incremental
- Zero-based budgeting
- Rolling budgets
- Activity-based budgeting
- Feed-forward control

1.2 Top down and bottom up budgeting

Top-down budgeting – budgets are prepared by senior management.

Bottom-up (participative) budgeting – managers participate in the preparation of their department's budget.

Advantage of two budgeting method

Top-Down Budgeting

- Senior management have greater control of the budgetary process. The budgets will, therefore, reflect **more accurately** the corporate objectives and the long-term plan.
- Using top-down budgeting **avoids budgetary slack**
- Since budgets are prepared centrally, the activities of the various departments should be **better coordinated**.

Bottom-Up Budgeting

- Managers are **more likely to accept the budgeted targets** for their departments and work towards achieving them。
- Managers have a more detailed knowledge of the work which their departments do than senior management and, therefore, can produce **more realistic budgets**.
- Managers may feel **more motivated** if they are given greater autonomy and more responsibility for their departments.

Appropriateness of imposed budget VS participative budget

Imposed budget	Participative Budget
<ul style="list-style-type: none"> • In newly-formed organizations • In very small business • During periods of economic hardship • When operational managers lack budgeting skills • Junior managers may be less proactive 	<ul style="list-style-type: none"> • In well-established organizations • In very large business • During periods of economic affluence(经济繁荣) • When operational managers have budgeting skills • Junior managers are very proactive

1.3 Incremental budgeting

An **incremental budget** is a budget prepared using a **previous period's budget or actual performance as a basis** with **incremental amounts added** for the new budget period. These increments will include adjustments for **inflation and planned increases in sales prices and costs**.

It is appropriate for:

The system is relatively simple to operate and easy to understand.

1.3.1 Usefulness of Incremental Budgeting

- Managers need only justify the increments.
- The system is **relatively simple** to operate and **easy to understand**.
- **Conflicts should be avoided** if departments can be seen to be treated similarly.

1.3.2 Problems with Incremental Budgeting

- Assumes activities and methods of working will continue in the same way regardless of whether they are needed.
- It gives no incentive for developing new ways of working or the reduction of costs.
- It encourages a "**spend it or lose**" mentality so that the budget is maintained next year.
- Any budgetary slack in a previous budget is not reviewed. It is also easier to add and justify budgetary slack to make achievement of budgets easier.

1.4 Zero based budgeting

The principle behind **zero based Budgeting (ZBB)** is that the budget for each cost centre should be made from '**scratch**' or **zero**. **Every item** of expenditure must be **justified in its entirety** in order to be included in the next year's budget.

It is appropriate for:

- ❖ Non-profit-making organization
- ❖ The department where resources are spent discretionary such as marketing, finance, personnel etc. it is not ideal for direct manufacturing costs.

1.4.1 Implementing zero based budgeting

There is a three-step approach to ZBB.

STEP 1 **define decision package**

Each manager identifies activities or programmes to undertake in the budgeted period. A "decision package" is then prepared for each activity. This is a mini-budget that analyses how much will need to be spent on the activity. There also may be some narrative explaining the benefits of the package and quantifying any revenues (or cost savings) if appropriate.

STEP 2 **evaluate and rank each activity**

A budget committee reviews all the decision packages and ranks them (in decreasing order of benefits). Management accepts each package up to the point at which the total budgeted expenditure is reached.

STEP 3 **allocate resource**

Resources are allocated to the activities selected in Step 2. The budget is then a consolidation of all the accepted packages.

1.4.2 The **advantages** of zero based budgeting are as follows.

- It forces budget setters to re-evaluate every activity. Obsolete activities are removed. Wastage and budget slack should be eliminated.
- Allocation of resources is linked to results and needs.
- It develops a questioning attitude and encourages managers to look for alternatives.
- It encourages a bottom-up approach to budgeting. This should encourage motivation of employees.

1.4.3 The **disadvantages** of zero based budgeting are as follows.

- Departmental managers may not have the necessary skills to construct decision packages. They will need training which requires time and money.
- Ranking the packages can be difficult, since many activities cannot be compared on the basis of purely quantitative measures. Qualitative factors need to be incorporated but this is difficult.
- It is a complex and time-consuming process.
- The organisation's management information systems might be unable to provide the necessary information.
- As the budgeting cycle is annual, short-term goals may be prioritised instead of long-term goals.

1.5 Activity-Based Budgeting (ABB)

1.5.1 Principles of ABB

Activity-based budgeting (ABB) follows principles of activity-based costing (ABC), with the **identification of cost drivers** to determine budgeted costs. Having decided how many units to produce and sell, the organisation then needs to define the cost of the activities required to produce them. These depend on the drivers identified for each activity.

1.5.2 Preparation of AB Budgets

Preparing activity-based budgets is rather like performing ABC in reverse. The following steps are used:

1. Estimate the budgeted volume of sales and production, in units.

2. For each activity (e.g. machine set-up), estimate the number of units of driver which would be required to support the budgeted volume of sales and production (e.g. the number of production runs).
3. Determine the cost of each unit of driver. This may require an analysis of factors such as labour time required, labour cost per unit, etc.
4. Calculate the budgeted cost of each activity (number of drivers × cost per unit of driver).

Example 1 Activity-Based Budgeting

ABC Co produces food for farm animals. It produces three ranges of food: poultry, cattle and sheep. The food is produced and sold in metric tonnes to agricultural wholesalers.

The company is preparing its budgets for the next financial year, and wishes to use an activity-based approach to budgeting for its overheads.

Directs costs per tonne are as follows:

	Poultry	Cattle	Sheep
Materials	\$500	\$700	\$850
Labour cost	\$120	\$140	\$800
Weekly production	1,000	750	900

The company uses ABC, and has identified the following support activities for which overhead costs are incurred:

Activity	Driver
Machine set-ups	Number of production runs
Ordering materials	Number of orders
Storage	Tonne days of storage

The expected number of drivers that will be used each week by each of the three products is shown as follows:

	Poultry	Cattle	Sheep
Production runs	8	15	9
Purchase orders	20	25	30
Tonne days of storage	14	18	36

The management accountant has already calculated the cost per unit of driver for the machine set-ups and storage as follows:

Activity	Cost per unit of driver
Machine set-ups	\$500 per production run
Storage	\$10 per tonne day

Unfortunately, the management accountant quit at the end of the last month, and you have been asked to complete the budget.

You have discovered the following information about the purchase order process:

1. Each order takes 30 minutes to process (on average). The cost of employing clerical staff is \$10 per hour. Clerical staff would work a minimum of 40 hours per week.
2. Office supplies are estimated to be \$180 per clerk per week.
3. Each clerk would require a desktop computer. The cost of providing the computer is estimated at \$20 per week.

Required:

- (a) Calculate the cost per purchase order, based on the information provided.
- (b) Prepare the weekly budgeted costs, showing the total budgeted cost of each activity separately.

Solution:

(a) Cost per purchase order

	\$
Clerical staff costs (one member of staff)	400
Office supplies	180
Computer (one clerk)	20
Total weekly cost	600

	\$
Number of purchase orders	75
Cost per order	8

Based on the number of purchase orders, 37.5 hours of clerical time per week would be required. Since clerks work for a minimum of 40 hours per week, it would be necessary to employ one full-time clerk.

(b) Weekly budgeted costs

	\$	\$
Materials $(500 \times 1,000) + (700 \times 750) + (850 \times 900)$		1,790,000
Direct labour $(120 \times 1,000) + (140 \times 750) + (800 \times 900)$		945,000
Total direct costs		2,735,000
Indirect costs:		
Machine set-ups $(500 \times (8 + 15 + 9))$	16,000	
Purchase orders $(8 \times (20 + 25 + 30))$	600	
Storage costs $(10 \times (14 + 18 + 36))$	680	
Total indirect costs		17,280
Total costs		2,752,280

1.5.3 Advantages of ABB

- Better understanding of what causes costs to be incurred may provide opportunities for cost reductions.
- May identify “non-value adding” activities which can be eliminated.

1.5.4 Disadvantages of ABB

- Complicated and expensive to implement as it requires detailed analysis of overheads and measuring of activities.
- As many fixed costs do not vary with changes in the volume of drivers in the short run, ABB may provide misleading information.

1.5.5 Appropriateness of ABB

It is most appropriate in these situations:

- The organisation has high overheads.
- There are many different activities (drivers) to which the overheads relate.
- The organisation has many products with differing production times and

methods.

1.6 Rolling budget

Rolling budgets (also called **continuous budgets**) a system of budgeting in which the budget is continuously updated., the budget horizon (typically one year) is kept constant by adding another month (or quarter) to the end of the budgeted period as each month (or quarter) expires.

It is suitable for organization which is **facing a period of uncertainty** or when the **pace of change** in the business environment **is fast and continual**.

They represent an attempt to prepare plans which are **more realistic**,

Example 2 Rolling Budgets Computation

Company A has computed a 2-quarter rolling budget for the costs of one of its outlets:

Quarter	1
	\$
Rental	4000
Labour	3000
Materials	4000
Overheads	1000
Total	12000

The following events has occurred:

1. The landlord has raised the rental from quarter 3 onwards by 10%, and Company A has accepted the revised rental agreement.
2. new labour regulation has forced minimum wage to increase by \$100 a month (\$300 per quarter) for workers earning minimum wage, from quarter 2 onwards. This outlet has 3 of these workers.

Example 2 Rolling Budgets Computation

3. The company has managed to secure new materials supply that is 15% cheaper than previously. The outlet will receive this new supply in quarter 3. Quantity of production and sales is the same for all 3 quarters.
- At the end of quarter 1, Company A will roll the budget into a new 2-quarter period (Quarter 3 and 4), with adjustments as shown:

Quarter	1 (ended)	2 (adjusted)	3 (new)
	\$	\$	\$
Rental	4000	4000	4400 (+10%)
Labour	3000	3900 (+900)	3900
Materials	4000	4000	3400 (+15%)
Overheads	1000	1000	1000
Total	12000	12900	12700

1.6.1 Usefulness of Rolling Budgets

- The budget is always updated to reflect external changes. It is therefore more relevant and more valid for comparison against actual performance.
- There will always be a budget for the next 12 months. This can be useful for planning things such as cash flows.
- Managers will be more motivated as the budget is more realistic, because it will be updated to take account of changes which occur outside of their control.

1.6.2 Problems with Rolling Budgets

- The process is more time consuming as budgets have to be regularly updated

and therefore **more costly**.

- Budgets may be changed to hide operational inefficiencies.

1.6.3 Appropriateness of Rolling Budgets

Rolling budgets are likely to be more appropriate in industries which are **dynamic**, where external changes can lead to the original budget quickly becoming out of date.

1.7 Feedback

A feedback control system is a system in which **outputs are monitored against a predetermined standard**, and if there are any deviations from the standard, action is taken to remedy these. The feedback is the information concerning the difference between the actual output and the desired output.

A budgetary control system is an example of a feedback control system.

1.7.1 Positive and Negative Feedback

Positive feedback means that the **output has achieved** or even exceeded the plan.

Negative feedback means that the **output is below the plan**.

1.7.2 Feed-forward control

In feed-forward control systems, **predicted future results** are compared against the **desired outcome**. If it appears that the desired outcome will not be achieved based on the current prediction, action can be taken now so that the desired outcome is achieved.

2. Changing budgetary systems

An organization which decides to **change** its type of budget used, or budgetary system, will face a number of **difficulties**.

- **Resistance to change** – employees who do not appreciate the value of change may be reluctant to help, particularly if it requires additional work.
- **Scepticism** – particularly at senior management levels. Managers who do not understand the benefit of the change may not give their full support.
- **Training everyone** involved in the process of change.
- **Additional time and costs** involved in moving to a new system

3. Budget systems and uncertainty

Preparing a budget involves forecasting which is open to risk and uncertainty.

Causes of uncertainty in the budgeting process include:

- **The overall economic performance of the markets** in which the business sells. Economic growth may lead to increased demand for products or services.
- **Actions of competitors.** A competitor's launch of a great new product may reduce demand considerably.
- **Performance of employees.** It may be difficult to estimate how productive employees will be and how many employees will actually be required.
- **Market prices of inputs.** The prices of many commodities (e.g. metals and oil) are determined by highly developed international markets and can be very volatile.
- **Demand for new products** will be uncertain. Popularity will not be known until the products have been launched. However, this uncertainty can be reduced through market research.

Some of the tools we have seen will help to deal with this.

- Flexed or flexible budgets;
- Rolling budgets; and
- Revision of the budgets at the end of the period before comparing with actual results.

3.1 Fixed and flexible budgets

3.1.1 Fixed budget

A fixed budget is a budget which remain unchanged throughout the budget period, regardless of difference between the actual and the original planned volume of output or sales.

The major purpose of a fixed budget is for planning.

3.1.2 Flexible budget

Flexible budget is a budget which, by recognizing different cost behavior patterns, is changed as the volume of output and sales changes by recognizing the different costs into fixed, semi-variable and variable components.

$$\text{Flexible budget} = \begin{cases} bx & \text{(revenue variable cost)} \\ a & \text{(fixed cost)} \\ bx+a & \text{(semi-variable cost)} \end{cases}$$

Example 3: preparing a flexible budget

Prepare a budget for 20X6 for the direct labour cost and overhead expenses of a production department flexed at the activity level of 80%, 90% and 100%, using the information listed below.

The direct labour hourly rate is expected to be \$3.75.

100% activity represents 60,000 direct labour hours.

Variable costs

Indirect labour \$0.75 per direct labour hour

Consumable supplies \$0.375 per direct labour hour

Canteen and other welfare service 6% of direct and indirect labour costs

Semi-variable costs are expected to related to the direct labour hours in the same manner as for the last five years.

Year	Direct labour hours	semi-variable costs
20X1	64,000	20,800
20X2	59,000	19,800
20X3	53,000	18,600
20X4	49,000	17,800
20X5	40,000(estimate)	16,000(estimate)

Fixed costs	\$
Depreciation	18,000
Maintenance	10,000
Insurance	4,000
Rates	15,000
Management salaries	25,000

Inflation is to be ignored.

Solution

	80% level	90% level	100 level
	48,000 hrs	54,000hrs	60,000hrs
	\$'000	\$'000	\$'000
Direct labour	180.00	202.50	225.00
Other variable costs			
Indirect labour	36.00	40.50	45.00
Consumable supplier	18.00	20.25	22.50
Canteen etc	<u>12.96</u>	<u>14.58</u>	<u>16.20</u>
Total variable costs(\$5.145 per hour)	246.96	277.83	308.70
Semi-variable costs(W)	17.60	18.80	20.0
Fixed costs			
Depreciation	18.00	18.00	18.00
Maintenance	10.00	10.00	10.00
Insurance	4.00	4.00	4.00
Rates	15.00	15.00	15.00
Management salaries	<u>25.00</u>	<u>25.00</u>	<u>25.00</u>
Budgeted costs	336.56	368.63	400.7

Working

Using the high/low method:

	\$
Total cost of 64,000 hours	20,800
Total cost of 40,000 hours	<u>16,000</u>
Variable cost of 24,000 hours	<u>4,800</u>
Variable cost per hour(\$4,800/24,000)	\$0.20

	\$
Total cost of 64,000 hours	20,800
Variable cost of 64,000 hours(*\$0.20)	<u>12,800</u>
Fixed costs	<u>8,000</u>

Semi-variable costs are calculated as follows.

	\$
60,000 hours (60,000*\$0.20) + \$8,000	= 20,000
54,000 hours (54,000*\$0.20) + \$8,000	= 18,800
48,000 hours (48,000*\$0.20) + \$8,000	= 17,600

4. Beyond Budgeting

Beyond Budgeting – a set of guiding principles to enable an organisation to manage its performance and decentralise its decision-making process without the need for traditional budgets.

4.1 Beyond Budgeting concepts

Two fundamental concepts underlie the Beyond Budgeting approach.

(a) **Use adaptive management processes for making decisions rather than tying decision-making to conformity with a rigid annual budget.**

(b) **Move towards devolved networks rather than centralized hierarchies.**

4.2 Benefits and limitations of beyond budgeting

Advantages:

- (a) Encourage innovation.
- (b) Increase motivation.
- (c) Allows faster response to threats and opportunities.

Disadvantages:

- (a) May be resistance to change from employees or management in adopting the Beyond Budgeting culture.
- (b) Resource constraints