November 2019

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P2 Advanced Management Accounting

Present Value Table

Present value of 1 i.e. $(1 + r)^{-n}$

Where r = discount rate
n = number of periods until payment

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	0·980	0·961	0·943	0·925	0·907	0·890	0·873	0·857	0·842	0·826	2
3	0·971	0·942	0·915	0·889	0·864	0·840	0·816	0·794	0·772	0·751	3
4	0·961	0·924	0·888	0·855	0·823	0·792	0·763	0·735	0·708	0·683	4
5	0·951	0·906	0·863	0·822	0·784	0·747	0·713	0·681	0·650	0·621	5
6	0·942	0·888	0·837	0·790	0·746	0·705	0·666	0·630	0·596	0·564	6
7	0·933	0·871	0·813	0·760	0·711	0·665	0·623	0·583	0·547	0·513	7
8	0·923	0·853	0·789	0·731	0·677	0·627	0·582	0·540	0·502	0·467	8
9	0·914	0·837	0·766	0·703	0·645	0·592	0·544	0·500	0·460	0·424	9
10	0·905	0·820	0·744	0·676	0·614	0·558	0·508	0·463	0·422	0·386	10
11	0·896	0·804	0·722	0·650	0·585	0·527	0·475	0·429	0·388	0·350	11
12	0·887	0·788	0·701	0·625	0·557	0·497	0·444	0·397	0·356	0·319	12
13	0·879	0·773	0·681	0·601	0·530	0·469	0·415	0·368	0·326	0·290	13
14	0·870	0·758	0·661	0·577	0·505	0·442	0·388	0·340	0·299	0·263	14
15	0·861	0·743	0·642	0·555	0·481	0·417	0·362	0·315	0·275	0·239	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	0·812	0·797	0·783	0·769	0·756	0·743	0·731	0·718	0·706	0·694	2
3	0·731	0·712	0·693	0·675	0·658	0·641	0·624	0·609	0·593	0·579	3
4	0·659	0·636	0·613	0·592	0·572	0·552	0·534	0·516	0·499	0·482	4
5	0·593	0·567	0·543	0·519	0·497	0·476	0·456	0·437	0·419	0·402	5
6	0·535	0·507	0·480	0·456	0·432	0·410	0·390	0·370	0·352	0·335	6
7	0·482	0·452	0·425	0·400	0·376	0·354	0·333	0·314	0·296	0·279	7
8	0·434	0·404	0·376	0·351	0·327	0·305	0·285	0·266	0·249	0·233	8
9	0·391	0·361	0·333	0·308	0·284	0·263	0·243	0·225	0·209	0·194	9
10	0·352	0·322	0·295	0·270	0·247	0·227	0·208	0·191	0·176	0·162	10
11	0·317	0·287	0·261	0·237	0·215	0·195	0·178	0·162	0·148	0·135	11
12	0·286	0·257	0·231	0·208	0·187	0·168	0·152	0·137	0·124	0·112	12
13	0·258	0·229	0·204	0·182	0·163	0·145	0·130	0·116	0·104	0·093	13
14	0·232	0·205	0·181	0·160	0·141	0·125	0·111	0·099	0·088	0·078	14
15	0·209	0·183	0·160	0·140	0·123	0·108	0·095	0·084	0·074	0·065	15

Annuity Table

Present value of an annuity of 1 i.e. $\frac{1-(1+r)^{-n}}{r}$

Where r = discount rate
n = number of periods

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	1·970	1·942	1·913	1·886	1·859	1·833	1·808	1·783	1·759	1·736	2
3	2·941	2·884	2·829	2·775	2·723	2·673	2·624	2·577	2·531	2·487	3
4	3·902	3·808	3·717	3·630	3·546	3·465	3·387	3·312	3·240	3·170	4
5	4·853	4·713	4·580	4·452	4·329	4·212	4·100	3·993	3·890	3·791	5
6	5·795	5·601	5·417	5·242	5·076	4·917	4·767	4·623	4·486	4·355	6
7	6·728	6·472	6·230	6·002	5·786	5·582	5·389	5·206	5·033	4·868	7
8	7·652	7·325	7·020	6·733	6·463	6·210	5·971	5·747	5·535	5·335	8
9	8·566	8·162	7·786	7·435	7·108	6·802	6·515	6·247	5·995	5·759	9
10	9·471	8·983	8·530	8·111	7·722	7·360	7·024	6·710	6·418	6·145	10
11	10·37	9·787	9·253	8·760	8·306	7·887	7·499	7·139	6·805	6·495	11
12	11·26	10·58	9·954	9·385	8·863	8·384	7·943	7·536	7·161	6·814	12
13	12·13	11·35	10·63	9·986	9·394	8·853	8·358	7·904	7·487	7·103	13
14	13·00	12·11	11·30	10·56	9·899	9·295	8·745	8·244	7·786	7·367	14
15	13·87	12·85	11·94	11·12	10·38	9·712	9·108	8·559	8·061	7·606	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	1·713	1·690	1·668	1·647	1·626	1·605	1·585	1·566	1·547	1·528	2
3	2·444	2·402	2·361	2·322	2·283	2·246	2·210	2·174	2·140	2·106	3
4	3·102	3·037	2·974	2·914	2·855	2·798	2·743	2·690	2·639	2·589	4
5	3·696	3·605	3·517	3·433	3·352	3·274	3·199	3·127	3·058	2·991	5
6	4·231	4·111	3·998	3·889	3·784	3·685	3·589	3·498	3·410	3·326	6
7	4·712	4·564	4·423	4·288	4·160	4·039	3·922	3·812	3·706	3·605	7
8	5·146	4·968	4·799	4·639	4·487	4·344	4·207	4·078	3·954	3·837	8
9	5·537	5·328	5·132	4·946	4·772	4·607	4·451	4·303	4·163	4·031	9
10	5·889	5·650	5·426	5·216	5·019	4·833	4·659	4·494	4·339	4·192	10
11	6·207	5·938	5·687	5·453	5·234	5·029	4·836	4·656	4·486	4·327	11
12	6·492	6·194	5·918	5·660	5·421	5·197	4·988	4·793	4·611	4·439	12
13	6·750	6·424	6·122	5·842	5·583	5·342	5·118	4·910	4·715	4·533	13
14	6·982	6·628	6·302	6·002	5·724	5·468	5·229	5·008	4·802	4·611	14
15	7·191	6·811	6·462	6·142	5·847	5·575	5·324	5·092	4·876	4·675	15

A. MANAGING THE COST OF CREATING VALUE

Chapter 1

ACTIVITY BASED COSTING & ACTIVITY BASED MANAGEMENT

1. Introduction

This chapter begins with revision of the key principles behind ABC costing which should be familiar to you from your CIMA P1 studies. Following this, we move on to look at other applications of the activity based approach namely **Activity Based Management (ABM), Direct Product Profitability (DPP), Direct Customer profitability** and **distribution channel profitability** – all of these techniques being mentioned specifically on CIMA's P2 updated syllabus.

1.1. Revision of ABC Costing

Traditional absorption costing systems share overheads across all products based on a single cost driver (usually machine or labour hours).

It is argued that a modern manufacturing environment requires a more sophisticated and intelligent costing system.

The automation of manufacturing environments gives rise to a greater proportion of overheads within total costs than was seen in past decades – so it has become more crucial that these costs are accounted for correctly.

Under ABC costing, overhead costs gain visibility and the activities which cause these costs are understood. The costing of products becomes more accurate as it will reflect the resources consumed in making that product . More accurate costs should result in better product decisions and pricing, both of which are essential in a globally, competitive environment.

The difference in an ABC calculated cost per unit compared to Absorption cost per unit can be quite significant particularly when there is a high overhead value to be shared across a diverse product range.

1.2. Example Case Study – XY co –Printer Manufacturer

Consider XY Co a printer manufacturer who produces two types of office printers.
One is a very simple model which prints only black and white text. The other is a high tech 'smart' printer with multiple capabilities.

Despite their differences, both printers take approximately 3 machine hours each to produce.

Their traditional absorption costing method, that shares the cost of overheads based on number of machine hours at a predetermined OAR rate assigns both models with a similar amount of overhead cost per unit.

However, when management scrutinise these overhead costs they find that the overheads relate to a variety of different causes. They include costs for activities such as quality inspections, wi-fi testing, ordering costs, customer service enquiries and so on.

Through conducting this analysis, they recognise that the high tech printer's complex requirements are causing the majority of the overheads. This printer requires a greater range of specialised quality testing, a greater number of component requisitions and also receives far more post-sale customer enquiries than the simple model.

Therefore, it is unfair to allocate the two printers the same amount of overheads based on a crude measure of machine hours. Instead the high-tech printer should attract the greater share of the overhead costs because they are largely caused by that model.

Through ABC this fairer cost allocation can be actioned.

Example 1

Explain the benefits which can be gained from better allocation of overheads and more accurate product costing.

1.3. Method – ABC Costing

You may be required to compute costs under an ABC system, therefore, a reminder of this process is given below:

- Identify the major 'activities' that give rise to overhead costs (e.g. quality testing, ordering costs etc)
- Determine what causes the cost of each activity – the **cost driver** (e.g. number of inspections, number of orders)
- Calculate the total costs for each activity – **the cost pools**.
- Calculate a cost per cost driver (e.g a cost per inspection)
- Allocate the overhead costs to product lines based on their usage of the cost driving activities.
- Calculate the overhead cost per unit for each item of output.
- Add the overhead per unit to other direct costs to find a full product cost under ABC costing.

NOTE on CIMA new objective test exams.
It is unlikely that CIMA objective tests questions (worth approx. 2 marks each) will require you to complete a full ABC cost allocation necessitating all the steps above. However, it is important to be familiar with the entire process before you can answer questions on isolated areas of the sequence.

Example 2

Una manufactures three products: A, B, and C.

Data for the period just ended is as follows:

	A	*B*	*C*
Production (units)	20,000	25,000	2,000
Sales price (per unit)	$20	$20	$20
Material cost (per unit)	$5	$10	$10
Labour hours (per unit)	2 hours	1 hour	1 hour

(Labour is paid at the rate of $5 per hour)

Overheads for the period were as follows:

Set-up costs	90,000
Receiving	30,000
Despatch	15,000
Machining	55,000
	$190,000

Cost driver data:

	A	*B*	*C*
Machine hours per unit	2	2	2
Number of set-ups	10	13	2
Number of deliveries received	10	10	2
Number of orders despatched	20	20	20

a) Calculate the cost (and hence profit) per unit, absorbing all the overheads on the basis of labour hours.

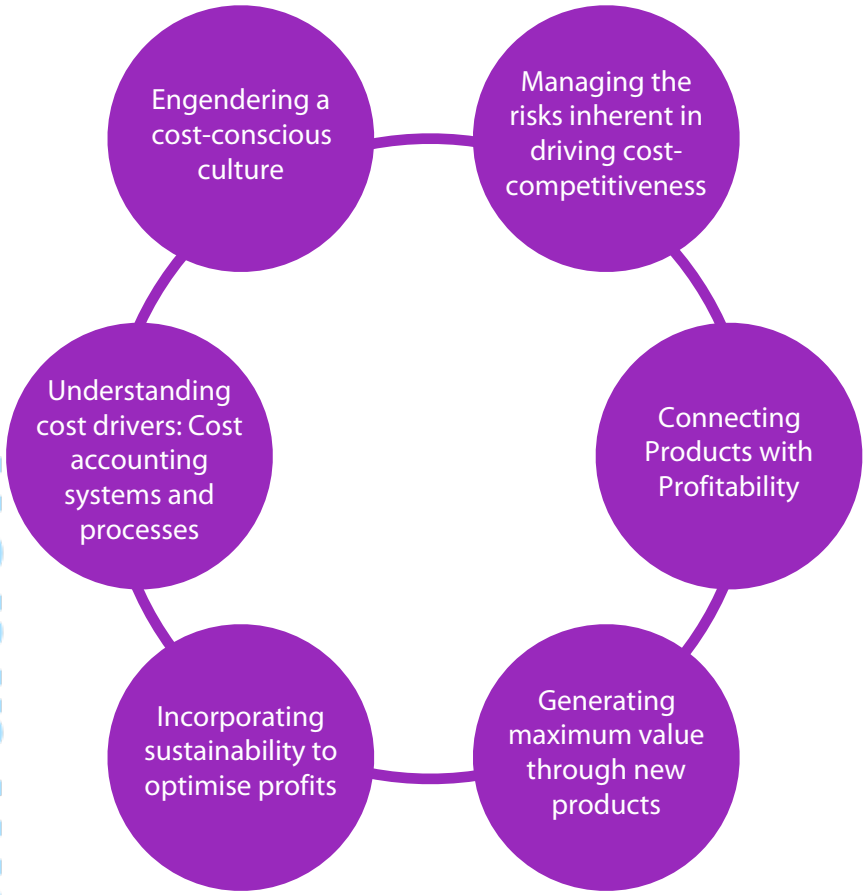
b) Calculate the cost (and hence profit) per unit absorbing the overheads using an Activity Based Costing approach.

2. ABC Cost Hierarchy

ABC costing classifies costs into the following categories.

- **Unit level cost –** are incurred with each unit of output -e.g. power is used by factory machines each time a unit is produced.
- **Batch level costs** –increase with each 'batch' of output -e.g. equipment set-up costs are incurred each time a new batch is processed.
- **Product Sustaining costs** – this type of cost does not increase in relation to batches or units produced, but are necessary costs to support particular product lines – e.g. design costs.
- **Facility level costs** – General manufacturing overheads which can not easily be traced to production activity e.g. admin staff salaries.

3. Strengths / Weaknesses of ABC Costing



The CGMA cost transformation model suggests six changes which are designed to to help businesses achieve and retain cost competitiveness.

- **Creating a cost conscious culture**
  - Organisations need to strive for cost-leadership (costs should be lower competitors – benchmarks should be used here)
  - Commitment to cost reduction needs to be throughout the organisation -all levels- all employees
  - Ability to use technology to control costs
- **Understanding cost drivers**
  - Investigation of cause of costs & impact of different variables on these costs.
  - Plans should look to reduce the drivers of costs AND costs themselves.
  - ABC costing is a tool to use here.
- **Managing the risks that come from a cost conscious culture**
  - Risks that impact quality & customer satisfaction
  - Risk management process needs to identify these risks and mitigate
- **Connecting products with profitability**
  - Ensuring products and services are profitable & make positive contribution
  - Allocation of shared costs and accurate individual product costs are important here

- **Maximising value from new products**
  - Profitability of new products must be assessed before production begins.
  - New products / services should aim to be adaptable/ flexible so can be changed to satisfy as many customer segments as possible
- **Incorporate Sustainability : Consider the environmental impact of products**
  - Negative impacts (such as creating unnecessary waste) can add costs as well as damaging reputation and sales.

Actions to Take / Dos

- Get buy-in from the rest of the business. ABC provides business managers, as well as the finance function, with the information needed to make value-based decisions
- Use ABC for pricing and product prioritisation decisions
- ABC should be implemented by management accountants as they are best placed to manage the process and to ensure benefits realisation

Actions to Avoid / Don'ts

- Do not get caught up in too much attention to detail and control. It can obscure the bigger picture or make the firm lose sight of strategic objectives in a quest for small savings
- It is important not to fall into the trap of thinking ABC costs are relevant for all decisions. Not all costs will disappear if a product is discontinued, an example being building occupancy costs.

4. Activity based management.

Activity based management uses the principles and information from activity-based costing to control and reduce unnecessary costs by focussing on their cause. This will streamline and drive continuous improvements through focusing on value as perceived by customers.

ABC costing will enable management to **better understand the cause of costs,** and from here action can be taken to control and reduce costs through controlling and reducing the demand for cost causing activities.

Activity based management applies this approach to **understand the true cost of other business outputs** – such as the true cost of dealing with customer segments, projects and services offered by the company.

ABM uses this insight to make better **operational and strategic decisions** for example, investment in new methods/ machinery, re-designing product components and changing service levels offered.

5. Activity Based Management Principles – in practice

- **Identify activities** within **all processes and functions** of the business.
- **Classify** these activities into **Value-adding** and **Non-value adding activities.**
- **Value adding activities** are crucial to the **organisation's success,**
- **non-value adding activities** represent **inefficiency and waste** and should be reduced, ideally eliminated.
- **Train and empower all staff** to be able to support activity based approach
- Improve profits through combining principles of lean production, continuous improvement and focus on increasing value from customer perspective.

5.1. Continuous Improvement – performance management under ABM

Successful implementation of ABM, will give management an understanding of costs relating to **value-adding** and **non-value adding activities** within the organisation.

The total costs of each type can then be monitored and the **performance of these activities** can also be measured – for example, in terms of speed, efficiency and quality.

5.2. Activity Based Management – conditions for success

- **Requires commitment of whole organisation** – a total culture change that will need to be incentivised and proactively managed through **effective leadership** and employee **involvement.**
- **Investment in terms of time and money** is needed to support a fully integrated ABM approach.
- **New systems will be required** relating to cost recording, performance measurement and reporting of information. This will be dependent on IT capabilities and compatibility of accounting systems with other parts of the organisation.
- **ABM should be aligned with strategic objectives** – not a short term focused cost-cutting exercise. It has to increase product profitability and value for customers**.**

6. Customer Profitability Analysis

Customer profitability analysis (CPA) is an application of Activity Based principles to customers or customer segments.

Revenues and service costs attributable to specific customer types are analysed to identify the customers' level of profitability.

Customers are supposed to be king, but it is often found that **some customers are more profitable** to a business than others.

Management may find that **some** customers are actually costing more than the revenue they

6.1. Pareto Analysis

It is often found that a small number of customers provide the majority of a businesses profit. Sometimes referred to as **80:20 rule or Pareto's law** this can be used to describe a situation where just **20% of the customers are responsible for 80% of the total profit**. Amongst the remaining 80% of customers, the rule suggests that half will contribute a lower margin and the other half will actually be loss making.

Using this knowledge, strategies can be formulated to ensure service levels are focused on **retaining the most profitable customers**, whereas the lower margin groups will have less time devoted to them (perhaps receiving automated services etc) and the genuine loss making customers may be discouraged or referred elsewhere.

Example 3

Vilnius Ltd manufactures components for the heavy goods vehicle industry.

The following annual information regarding three of its key customers is available.

	X	*Y*	*Z*
Gross margin	US$897,000	US$1,070,000	US$1,056,000
Orders placed	200	320	700
Sales visits	80	100	140
Invoices raised	200	320	700

The company uses an activity based costing system and the analysis of customer-related costs is as follows.

Sales visits	$420 per visit
Order processing	$190 per order placed
Despatch costs	$350 per order placed
Billing and collections	$97 per invoice raised

Using customer profitability analysis, how would the customers be ranked?

6.2. Customer profitability statement

There is no set format for the statement, but it would normally be similar to the one below.

	$'000	*$'000*
Revenue at list prices		100
Less: discounts given		8
Net revenue		92
Less: cost of goods sold		50
Gross margin		42
Less: customer specific costs	28	
financing costs:		
credit period	3	
customer specific inventory	2	
		33
Net margin from customer		9

Example 4

Frodo Ltd supplies shoes to Sam Ltd and Gollum Ltd. Each pair of shoes has a list price of $50 and costs Frodo Ltd $25. As Gollum buys in bulk it receives a 10% trade discount for every order for 100 pairs of shoes or more. Sam receives a 15% discount irrespective of order size, because that company collects the shoes, thereby saving Frodo Ltd any distribution costs. The cost of administering each order is $50 and the distribution cost is $1,000 per order. Sam makes 10 orders in the year, totalling 420 pairs of shoes, and Gollum places 5 orders of 100 pairs each.

Which customer is the most profitable for Frodo Ltd?

6.3. Customer profitability and Customer lifecycle

Before undertaking action relating to customer profitability - management should also factor in **customer lifecycle**. Customers may start off loss making. It costs money to acquire their business and promotional offers may be necessary. From here they may develop into long term profitable revenue streams.

Example 5

Consider a high-street banking business who is seeking to attract student customers whom they realise have very little money.

They are offering this customer group, a free railcard, a large 0% interest overdraft and a dedicated student business advisor.

What is the justification of this and how does it fit with the customer lifecycle in terms of long term profitability.

6.4. Direct Product Profitability

Direct Product Profitability is mainly seen in **retailing sector.**

This applies the **Activity based principles** as before, but this time to find a true product cost - including its purchase price and any indirect costs of distribution, warehousing and retailing.

By comparing this true cost to selling price – a net profit per product can be obtained.

Costs such as warehousing and transport may be allocated based on the volume or area that the product consumes. Other costs such as handling costs can be attributed to number of pallets handled.

6.5. Distribution channel profitability

A distribution channel is the point of purchase for a customer.

This may be via website, a telephone call, a shop or mail order catalogue, for example.

As previously, each channel offered can be analysed in terms of its true cost and so the relative profitability of each channel can be obtained.

Decisions on future selling methods and product pricing can then reflect these findings.

The impact of digital techniques on distribution channel profitability

In the event of modern technology the range of distribution channels has widened.

Profitability has been enhanced for many companies who have been able to take advantage of electronic distribution channels such as email, direct downloads, phone apps and social media along with traditional websites.

Not all products and services are suitable for distribution in this way but many retailers have been able to reach new markets and gain customers through use of new digital channels.

For example, software developers are able to use Apple's app store to sell their digital products direct to the customer. Amazon have opened similar opportunities to sellers of physical goods via their online marketplace.

Chapter 2

MODERN MANUFACTURING ENVIRONMENT

1. Introduction

To compete in the current global, competitive market, modern businesses have needed to adapt and to embrace new systems, approaches and technologies.

This chapter introduces some of the developments of modern manufacturing which have transformed and fundamentally changed the nature of business operations and the role of management accountants.

2. Modern Manufacturing

The **following aspects** should help you to **recognise** areas of notable change within the **modern manufacturing** compared to the **traditional environment.**

(1) Level of competition

(2) Distribution networks

(3) Impact of technology

(4) Consumer power.

(5) Globalisation

(6) Product Lifecycle

(7) Product diversity/customised orders

(8) Advanced Production methods –robotics

(9) Quality requirements

(10) Environmental and sustainability concerns.

(11) Impact of the worldwide web.

(12) Legislation and Regulation.

(13) Attitude towards and participation of employees.

(14) New performance 'metrics'.

3. Just In Time (JIT)

You should be familiar with the principles of **Just in time** (JIT) systems your previous studies.

Example 1

Can you recall the features of JIT and its relationship/ requirements in terms of the following:

a) Levels of inventory holding?
b) Supplier relationships?
c) Maintenance of machinery?
d) Empowerment of workers?
e) Pull production flow?
f) Quality?
g) Wastefulness

Example 2

Note down some of the benefits and problems of JIT.

a) Benefits
b) Drawbacks

Example 3

Outline the distinction between Just-in-time production and Just in time purchasing?

4. Supply Chain Management

Supply chain management considers the relationships and components within the supply chain which work together to provide end customers with products.

Typical supply chain stages consist of:

- Suppliers> manufacturers> distributors> retailers> customers.
- Effective management and integration of the supply chain flows should result in increased profitability.

4.1. Supply Chain Management – areas for consideration:

- **Purchasing** (enhanced supplier relationships and formation of strategic alliances to improve service and quality)
- **Inventory Management and Reporting** – better stock control – use of technology to provide real time accurate stock levels to customers and other components in the supply network.
- **Customer Order Process** – Needs to be accurate, rapid, smooth, flexible and responsive to customer needs –ensuring efficient completion of sale order and increasing the likelihood of customer returning for repeat purchases.
- **Delivery / distribution logistics–** fast, reliable and accurate delivery to customers – again enhancements are possible through technology and relationships with delivery distributor/ courier systems.

5. Quality.

Quality may mean different things to different people. – a dictionary definition, for example, suggests the term 'excellence'. However, a new way at looking at quality is to focus on the **user.**

In this respect, '**user satisfaction'** and '**fitness for use'** have become modern definitions for quality.

5.1. Quality and costs

Quality may cost businesses more initially however the gains are longer term in the form of savings and additional profits stemming from customer loyalty and brand value. The idea is by spending more on prevention and detection costs – known as conformance costs – a business can save potentially much more by avoiding the costs of failure (non-conformance costs).

6. Conformance Costs

- **Prevention Costs** – Cost of preventing defects before they occur – example is training procurement staff on purchasing quality materials.
- **Appraisal Costs** – this is the cost of inspecting and testing. For example, quality inspections of components before they are used.

7. Non- conformance Costs

- **Internal Failure Costs** – Costs of quality failures incurred by the firm before the product reaches the customer – eg cost of reworking or scrapping items.
- **External Failure costs** – refer to costs of poor quality that occur after the product / service has reached the customer. This may include cost of returned items, loss of goodwill or reputation.

8. Total Quality Management (TQM)

Total Quality Management (TQM) is a **modern management approach** that is aims to **increase competitive advantage** through focus on the **customer** and a **commitment to quality.**

TQM requires an organisational wide commitment to meeting **customer expectations** and **improving existing results** whilst **embedding quality** throughout.

Full dedication from senior management is crucial for this approach to be successful - this attitude needs to filter down and be embraced by everybody working in or with the company.

8.1. The basic principles

- **Customer Focus** – the customer is deemed the most important asset of the company. The organisation needs to design its products and processes from a customer point of view.
- **Get it right, first time.** Focus on prevention rather than detection of errors**.** Taking action to avoid the cost of rework or faulty items.
- **Continuous improvement** – through constant process of performance measurement and a willingness to change current processes. It embraces innovation and change. Also eliminating waste is a part of this**.**
- **Employee Participation** Employees are 'internal customers' who should be given responsibility, trust and empowerment. Rewards and recognition are crucial, as is regular communication. Training in TQM and other skills is positively encouraged. It is believed that this treatment will result in a talented, motivated and committed workforce.

8.1. Quality Circles

A small group of volunteer employees who meet regularly to discuss, analyse and make suggestions aimed to improve work-related problems. Discussion topics will focus on quality matters but can extend to other parts of the working environment.

The idea originated in Japan and can play an important part in employee involvement, motivation and participation.

9. Business Process Engineering (BPR)

BPR requires businesses to **fundamentally and dramatically rethink and redesign** how they do their work.

Business processes will be identified, analysed and then redesigned with the aim of reducing costs, improving customer service and enhancing performance in terms of quality, speed and service levels.

9.1. Elements of BPR

- Focus on customer
- Focus on the process
- Use of IT as Key Enabler
- Breakthrough Objectives

Challenge Underlying Assumptions

Reduction of Costs

Productivity optimised processes

A key part of the redesign is **using IT** to transform and innovate processes.

Example 4

Identify the key differences between Continuous Improvement and Business Process Engineering.

10. Theory of Constraints and Throughput

Goldratt's **Theory of Constraints** is an important management methodology which can be applied to systems that are unable to meet their goals (usually maximising profit) due to a constraint. Management should ensure that efforts are focussed on making the best possible use of this limitation. Ideally the constraint will need to be eliminated in the longer term, meanwhile Goldratt recommended reorganising all other system activities around to the constraint to ensure its use is optimised. The constraint in manufacturing is referred to as **a bottleneck.**

The five stages of Theory of Constraints (TOC) which are summarised by the above paragraph:

- Identify constraint
- Exploit constraint
- Subordinate other activities / non-constraints
- Elevate the Constraint
- Repeat the process

Goldratt refers to **Throughput** as a **key performance measure.** The main concepts of throughput accounting are given below.

Throughput is the rate at which the system generates money. It is measured in monetary terms and links directly to profitability therefore the objective is to maximise throughput values or throughput flow.

Throughtput ($) = **Sales Revenue less Direct Material Costs**

In the short run, **ALL costs (except direct materials) are viewed as being fixed.** This includes LABOUR as Fixed cost. The sum of all these production costs including labour is called **TOTAL FACTORY COSTS.**

The constraint on production is referred to a **Bottleneck.**

Throughput accounting is suitable for use in a **Just-in-time environment.**

Key formulae:

Throughput ($) = Sales revenue – Direct Material costs

Total factory costs = ALL production costs (except materials)

$$\text{Return per factory hour} = \frac{\text{Throughput per Unit \$}}{\text{Time per unit in bottleneck resource (hrs)}}$$

$$\text{Cost per factory hour} = \frac{\text{Total factory cost (inc labour +overheads)}}{\text{Total time available in Bottleneck (ALL hrs)}}$$

$$\text{Throughput accounting ratio (TPAR)} = \frac{\text{Return per factory hour (1)}}{\text{Cost per factory hour (2)}}$$

Interpretation of TPAR ratios:

The TPAR ratio should be greater than 1 for the product to be classed as **financially viable**. Priority should be given to the products which generate the highest TPAR ratios.

Products with a TPAR ratio **less than one** should be discontinued.

Example 5

Pi plc manufactures 2 products, A and B.

The cost cards are as follows:

	A	*B*
Selling price	25	28
Materials	8	20
Labour	5	2
Other variable costs	7	2
Fixed costs	3	2
	23	26
Profit	$2	$2
Machine hours p.u.	2 hrs	1 hr
Maximum demand	20,000 units	10,000 units

The total hours available are 48,000.

a) Calculate the optimum production plan and the maximum profit, on the assumption that in the short-term only material costs are variable i.e. using a throughput accounting approach

b) Calculate and comment on the Throughput Accounting ratios (TPAR ratios)

Chapter 3

TARGET COSTING

1. Introduction

Target costing is a specialist accounting technique that well suited to a modern globally, competitive environment. It plays a key role as a **pro-active cost reduction system** and is seen, along with life cycle costing, to contribute to **long term profitability.**

Later in this syllabus, we will look at detailed pricing strategies chapter – however, traditionally a very common approach to obtain a **selling price** is to calculate this based on a **cost per unit** with an added a '**mark up' or 'margin'.** This ensures the selling price covers the cost of the item and provides a level of **profit** for each unit sold.

One problem with this traditional approach, is that it may result in a final selling price that is unacceptably high to customers and will not sell in sufficient numbers.

Rather than finding their own selling price, target costing accepts the external selling **price levels as set by the market** and seeks to design products and processes that can be sold profitably through achievement of a **target cost.**

Much of work to meet a **target cost** is done at the early **product development stages.** This is crucial exercise **in cost control and reduction –** by making changes at design stage the costs are eliminated and also prevented from being **locked in** before production begins.

Value engineering and Functional analysis are methods employed during target costing when considering cost reducing design changes. They support the identification of cost effective modifications that will not negatively impact the value placed on the product or its features, by the consumer.

If target cost can not be achieved in some cases production of the units will not go ahead.

2. Target costing

2.1. The steps involved are:

- Determine the market selling price for your product **(target selling price)**
- **Determine the profit required** *(a required profit margin, or markup %)*
- Calculate the maximum cost allowable per unit that will achieve the required profit and meet the selling price **(the target cost).**
- **Compare estimated / actual costs with the target cost**.
- **Take action to close a Target Gap** (where estimated/ actual cost per unit exceed the target cost).

Example 1

Packard plc are considering whether or not to launch a new product. The sales department have determined that a realistic selling price will be $20 per unit.

Packard have a requirement that all products generate a gross profit of 40% of selling price.

Calculate the target cost.

Example 2

Hewlett plc is about to launch a new product on which it requires a pre-tax ROI of 30% p.a..

Buildings and equipment needed for production will cost $5,000,000.

The expected sales are 40,000 units p.a. at a selling price of $67.50 p.u..

Calculate the target cost.

3. The use of the target cost – Target Gap

Once the target cost has been determined, it will be compared with the estimated actual cost of production. The excess of the actual cost over the target cost is known as the **target cost gap,** and the company will then be focussing on ways to close this gap.

4. Suggestions to close the Target Cost Gap?

Note– Methods suggested should not seek to cut quality.

Example 3

Rollo Co are a car manufacturer who face intense competition from other automotive manufacturers in their industry. They are considering production of a small hatchback car – which will be known as the Rolla.

All Rollo's key competitors produce a small hatchback model, which are aimed at the same market segment. The selling price of these cars on the market averages at $10,000 each regardless of manufacturer.

The cost of producing the Rollo has been estimated at $9750

Rollo's shareholders require a mark-up of 25% on all retail car sales.

a) Using traditional mark-up pricing- calculate the expected selling price of a Rolla car. Explain what will happen if production goes ahead at this point.

b) Calculate a Target cost and Target Cost Gap – briefly explain what each of these represents.

c) Suggest three ways that Rollo could take steps to meet this cost – without impacting the quality or usefulness of the product.

5. Kaizen Costing

Kaizen costing is based on Japanese word **Kaizen** meaning **continuous improvement.**

When applied to costing – this refers to **cost reductions** that can be achieved through **small incremental improvements** achieved on an **ongoing basis,** rather than large radical changes.

Kaizen costing occurs during **manufacturing stage** and seeks to empower all workers to achieve continual small cost reductions which will have a positive effect and reduce overall costs.

The reduction in costs resulting from Kaizen costing will be much smaller than those from target costing. Target costing changes are usually made at the **design stage** of the product and work to prevent unnecessary costs from being 'locked in'.

A company may go ahead production despite a product not quite meeting its target cost, with the aim that eventually Kaizen costing and other improvements will achieve the necessary cost reductions in the longer term.

6. Using technology to reduce costs

Technology can be used to reduce costs for example:

- Software such as CAD (computer aided design) has become inexpensive and virtually free to use
- Innovations such as 3D printing have reduced costs of product prototyping, testing and refinement.
- Digital products such as music, games and other media can be produced a fraction of the cost due to new technology.
- Advertising and marketing costs are reduced through social media and pay-per-click which more effectively targets customers and reduces wasted spend.

7. Value Analysis / Value Engineering

Both **Value Analysis** and **Value engineering** seek to understand value as perceived by the customer or user of the product. The aim is to identify **cost effective changes** that can be made, in terms of product composition or design, in a way that **will not reduce the perceived value.**

Modifications or improvements are sought that provide **cost reduction** but will result in **enhanced** or **equivalent value** being placed on the product – **without effecting its quality, reliability or functionality.**

- **Value Analysis** is a cost reduction exercise which relates to an existing product.
- **Value engineering** relates to redesign of products that have not yet be produced.

Aspects of Value:

- **Cost Value**
- **Exchange Value**
- **Use Value**
- **Esteem Value**

8. Functional Analysis

Similar to value analysis this involves an examination of the product as perceived by the customer. Functional Analysis considers the value and cost of each function of a product.

Aim is to understand the values placed on functions and where possible develop cost-effective alternatives to provide these, without reducing the customers perception of product worth.

It can be extended to services, organisational structure and other applications of cost control.

For example – installing a tea machine may be a cost effective alternative to employing canteen staff to serve tea. The **function** of fresh tea provided on demand has been met but the method of delivery is more cost effective.

Chapter 4

LIFE-CYCLE COSTING

1. Introduction

Life cycle costing is a modern technique designed to support the **long term profitability** of a business.

This method aims to ensure that the **lifetime sales revenue** of a product will be sufficient to cover all of the costs incurred in its lifetime.

This technique works particularly well with **target costing** (later chapter) which proactively makes changes at the product's design stage to reduce costs and prevent unnecessary expenditure from being 'locked in'.

The overall lifecycle cost of a product should be reduced when effective target costing is exercised prior to production.

2. Lifecycle Costing

Profits are earned when **total revenue** *exceeds* **total costs. Life cycle costing** requires management to consider ***all costs*** (past, present and future) within this total .

Lifecycle costing encourages a long term perspective and includes costs such as those incurred in bringing the product to market and those which follow its withdrawal from sale. From here management can measure **total profitability** of a product and so make better decisions relating to its production and sale.

Traditional financial accounting may cause the true lifetime cost of a product to be overlooked or underestimated mainly because associated costs fall into different accounting periods.

It is important for P2 that you know the **key terms** and **lifecycle stages** but also that you consider how to ***apply*** **this knowledge via marketing and sales strategies, in order to maximise total long term profits**.

For example – when may price skimming or price penetration be appropriate? Can a product with a short expected lifecycle be sold at a higher price in order to recoup early development costs –or will this negatively impact demand levels?

Please refer to the chapter on pricing for more information on pricing strategies.

3. The product life cycle

You are likely to be familiar with the **concept of the product lifecycle** from previous studies.

The costs and revenues relating to a product, are likely to be different at different stages of its life. For example, during the initial development of the product the costs of researching and so on are likely to be high while the sales revenue is likely to be nil– i.e. the product is likely to be loss-making at this early stage in its life.

If costings (and decision based on the costings) were only viewed with short term perspective, it could easily lead to poor decisions.

Life-cycle costing identifies the phases in the life-cycle and causes management to **consider the different costs and revenues** that occur during the full **life of the product.**

3.1. The product life cycle (5 phases)

Development

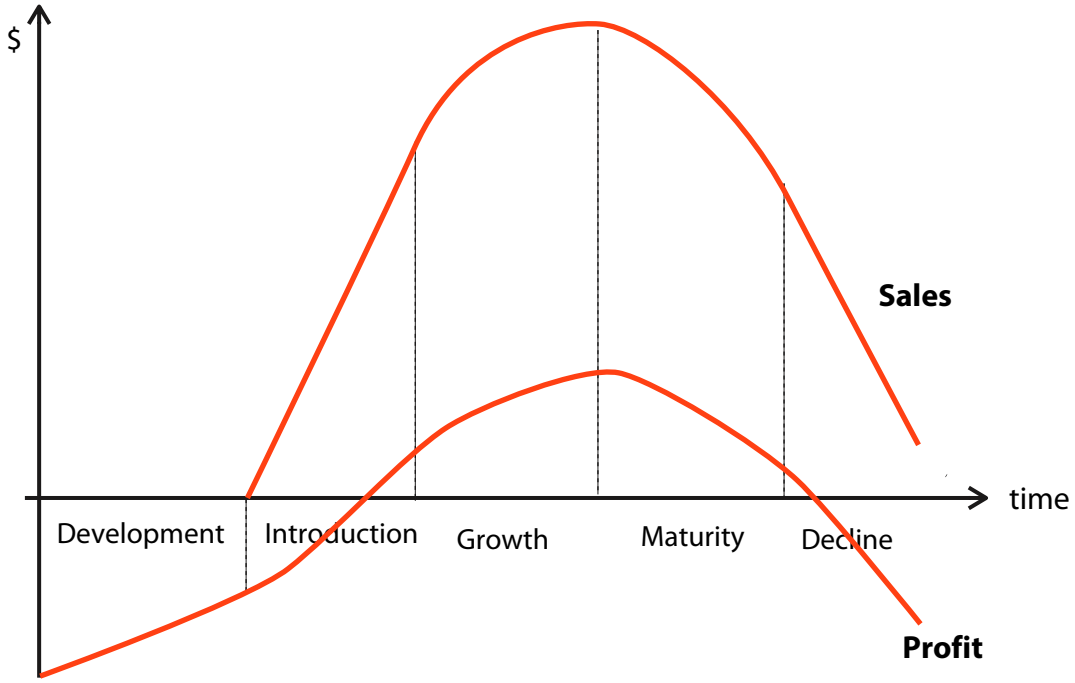
Introduction

Growth

Maturity

Decline

The effect of these stages on **sales revenue** and **profits** can be illustrated diagrammatically as follows:



4. Lifecycle cost calculation

Lifecycle costing accumulates **all the costs which are attributable to a product** over its life cycle. Viewing these over a **multi-period perspective** enables management to evaluate and improve the ***total profitability*** of a product line.

$$\text{Lifecycle cost of product} = \frac{\text{Total costs of product during its lifespan}}{\text{Total production units of product}}$$

Traditional accounting methods can lead to a products profitability being viewed from **too narrow** a perspective. The success of a product may be judged only by **current margins** which are based on production costs only. This **fails to link** ,for example, the high **early development costs** that are often written off as prior period expense or the **future exit costs** which are necessary for withdrawal from market.

Example 1

Use the five phases of the product lifecycle to suggest typical costs that are likely to be incurred at each stage in a products life.

Example 2

A company is planning a new product. Market research suggests that demand for the product would last for 5 years. At a selling price of $10.50 per unit they expect to sell 2,000 units in the first year and 12,000 units in each of the other four years.

It is estimated that the lifetime costs of the product will be as follows:

Manufacturing costs	$6.00 per unit
Design and development costs	$60,000
End of life costs	$30,000

Calculate the lifecycle cost per unit and determine whether the product is worthwhile to produce?

5. Maximising Revenue using Lifecycle Model.

Through application of the product life cycle model to their own products, businesses can take action to maximise the profitability.

5.1. Key examples

- **'Design costs' out of products**

  Involves taking action at design stage to minimise future costs – eg consider future product compatibility, implementing quality will result in lower warranty claims, using environmentally sourced product components to reduce waste and disposal costs etc. This links with **target costing** which focuses on reducing costs through product / process design changes made in the early stages of the life cycle.

- **Minimise the time to market**

  Take action to **minimise the time period** between conception and introduction. This period is loss making and steps should be taken to ensure products start to earn revenue as quickly as possible.

  This is also a key time for **profit-skimming** or **gaining market share** before a competitors are able to copy your product.

- **Minimise breakeven time**

  After a product reaches the point where **total revenue = total costs**, it can be viewed as profitable. Its important this point is reached as early as possible to maximise profits before popularity declines

- **Maximise the length of the life span**

  Take action to keep a product selling, for as **long as possible at the maturity stage** where **costs are low** and **profits are stable.**

  This includes finding ways to **extend the product lifecycle** – such as reducing selling prices, finding new markets, increase promotion**.**

6. Benefits of Lifecycle costing

- Encourages **longer term product evaluation** which can be overlooked due to single period financial accounting conventions.
- Facilitates **proactive sales and marketing techniques** to increase product profitability
- Better visibility of **total profitability** of a product allowing for comparison and better overview of performance.
- Management gain awareness of **cost consequences** and cost implications of earlier decisions.
- Management can **learn from previous** product costing and feedback from longer term perspective – for example gauge the effectiveness of the measures taken at design stage, on the overall profitability.
- Can encourage **higher quality products, better environmentally friendly output and increased innovation** due to investments made in development stages which are designed to reduce later costs.
- The model can be adapted so that future costs and revenues (later in the lifecycle) **can be discounted** to reflect **time value of money.**

7. Customer Life cycles

Customer lifecycle is a term to describe the phases that a customer relationship goes through. The longer the customer is retained in the most profitable stages of the lifecycle, the greater the total profitability from that customer. Identification of the stages of customer lifecycle can enable businesses to plan targeted marketing strategies aimed at maximising returns.

Example 3

a) Explain, with examples why a customer may not be profitable to a business in the early stages of a relationship.

b) Suggest methods a business could use to lengthen the period of time customers spend in the profitable phase.

B. MANAGING AND CONTROLLING THE PERFORMANCE OF ORGANISATIONAL UNITS

Chapter 5

DIVISIONAL PERFORMANCE MEASUREMENT

1. Introduction

In this chapter we will look at performance measurement within **divisionalised** (or decentralised) organisational structures.

The section recaps your knowledge of **responsibility accounting** and considers the **behavioural consequences** that can result from different methods of divisional performance measurement.

2. Divisionalised structures

A **divisionalised** structure is based on the principles of **responsibility accounting** in which divisions are 'responsibility centres' who are each accountable for their own financial results. This structure can provide an effective way to manage a large business.

Divisions are usually organised by **product line, customer type or geographical location.** The management of each division are granted a **degree of autonomy** over decision making. This means they can make certain major decisions without explicit permission from Head office or executive board. In effect they are allowed to run their part of the business almost as though it were their own separate company.

2.1. Advantages of divisionalisation:

- Focus on specialisms of product/location/customer type.
- Greater motivation for divisional management – performance appraisals will be based on more controllable factors.
- Faster decision making.
- Enables divisions to be classified as profit centers (providing motivation and promoting efficiency)
- Allows divisional performance to be compared.
- Results in clearer, more relevant objectives for management (they must concentrate on one division of the business only.)
- Usually results in better decisions made at local or product level.

2.1. Problems with divisionalisation:

- Coordination difficulties may occur. By delegating greater autonomy there is a concern that overall control will be lost.
- Requires transfer prices to be established for intercompany sales.
- Lack of goal congruence/dysfunctional decision-making may result.
- Difficulties in 'fair' comparison of divisions – causing demotivation of management.
- Potential duplication of some activities throughout the company.

3. Divisional performance measurements for control purposes.

As discussed, when **autonomy has been delegated** to divisional management they will have **the authority** to make **business critical decisions.**

There is always a concern that this could result in a **loss of control** for the **company as a whole.**

Therefore in order to **manage a divisionalised structure** – in accordance with **responsibility accounting** - **division results** are measured and evaluated against targets at regular intervals (often quarterly).

If this process is **successfully managed then performance targets will**:

- Indicate areas of success or poor performance within the divisions.
- Motivate divisional managers in a way that meets the overall organisational objectives.
- Allow the company to measure how much each division contributes to the total business results.

However, **poorly designed performance measures** can be an area for **disagreement and demotivation** amongst employees. The divisional units may respond to performance targets in a manner that is **dysfunctional** and **not goal congruent** with company objectives.

For example, suppose a manager was simply given one performance measure – to increase profits. This may seem sensible, in that in any normal situation the company will want the division to become more profitable. However, if the manager expects to be rewarded on the basis of how well he achieves the measure, all his actions will be focussed on increasing profit to the exclusion of everything else. This would not however be beneficial to the company if the manager were to achieve it by taking actions that reduced the quality of the output from the division. (In the long-term it may not be beneficial for the manager either, but managers tend to focus more on the short-term achievement of their performance measures.)

It is therefore necessary to have **a series of carefully constructed financial** and **non-financial** performance measures for each division manager.

We go on to discuss financial measurements only in this chapter – non-financial indicators can be found elsewhere in these course notes.

4. Responsibility Centres & performance measures

Responsibility centres are generally categorised as:

Cost centres –

Profit Centres –

Investment centres –

The status of the division will affect the performance measures used.

Example 1

Suggest some performance measures / financial ratios that might be suitable to evaluate the performance of centre types below:

a) Cost centre

b) Profit Centre

c) Investment Centre

Controllable / Uncontrollable Costs

Whether using cost, revenue or investment measures its vital that the performance of the **divisional manager is only assessed** on **controllable factors.**

E.g. The performance of a divisional **cost centre** manager should not be judged on costs that are outside his remit – e.g. centrally allocated head-office costs which are shared across divisions should be removed from results.

Nor would it be appropriate to measure **cost centre** performance using measures which relate to sales revenue and profit.

5. Investment centres

When a division is classed as an **investment centre**, the manager is given decision-making authority not only over costs and revenues, but can also over **capital investment decisions.**

The results of the investment decisions can be evaluated by measures that relate **profitability to capital expenditure.**

It is important that investment centres are **not assessed on their absolute profits** alone – otherwise there is no indication what level of investment capital was needed to generate those returns. For example, $10,000 p.a extra profit may appear healthy – but this could be a result of $10 million investment – so not really a good level of return.

The most common way of relating profitability to capital investment is to use **Return on Investment (ROI)** as a measure.

ROI is criticised for causing goal incongruence and another measure, **'Residual Income'** (next) is theoretically better.

6. Return on Investment (ROI)

$$\textbf{ROI} = \frac{\text{Controllable Annual Profit}}{\text{Capital Investment}} \times 100$$

- Similar to Return on Capital employed ratio.
- Quoted in % terms.
- Popular & commonly used
- Ensure that you have ANNUAL profits within your calculation (if monthly need to x12)

Example 2

Arcania plc has divisions throughout the Baltic States.

The Ventspils division is currently making a profit of $82,000 p.a. on investment of $500,000. Arcania has a target return of 15% (company WACC)

The manager of Ventspils is considering a new investment which will require additional investment of $100,000 and will generate additional profit of $17,000 each year. The investment will enhance their product and improve brand reputation in the market.

a) Calculate whether or not the new investment is attractive to the company as a whole.
b) Calculate the ROI of the division, with and without the new investment and hence determine whether or not the manager would decide to accept the new investment.

In the above example, the manager is motivated to accept an investment that is attractive to the company as a whole. **He has been motivated to make a goal congruent decision.**

However, there can be problems with a ROI approach as is illustrated by the following example:

Example 3

The circumstances are the same as in Example 2 , except that this time the manager of the Ventspils division is considering a commercially worthwhile investment that will cost $100, 000 and will give additional profit of $16,000 p.a.

a) Calculate whether or not the new investment is attractive to the company as a whole.
b) Calculate the ROI of the division, with and without the new investment and hence determine whether or not the manager would decide to accept the new investment.

Note – in this example the manager is not motivated to make a goal congruent decision. This is one reason why Residual income method is seen as technically superior.

7. Residual Income

Residual Income = Controllable Profit ***less*** Notional Interest on Capital

Residual Income approach assesses investment centre management in terms of **absolute profit.**

It shows the amount of profit that is remains after interest is paid on capital.

Notional means an 'imputed, or 'pretend' interest charge is deducted from the profit figure. The balance remaining is known as the Residual Income.

The company cost of capital (WACC) will be used to compute the interest charge.

Example 4

Repeat examples 2 and 3, but in each case assume that the manager is assessed on his Residual Income, and that therefore it is this that determines how he makes decisions.

8. ROI vs RI

8.1. Both RI and ROI

Will favour divisions with older assets because depreciation and inflation will erode the value of this capital – thus boosting the performance results for a given level of profit.

Both RI and ROI are based on profit – **rather than cash measure** – so can be affected by choice of accounting policies and other accounting estimates.

8.2. Strength and Weaknesses of ROI

Similar to ROCE – percentage form - preferred by managers

- Intuitive and straightforward comparative tool – eg compare ROI % with a company target.
- Encourages maximization of ROI which **may** be how shareholders also judge the company.
- Suitable for comparing divisions of **different sizes**

BUT

- May lead to dysfunctional decision making. Financially viable projects may be rejected by divisional managers, simply because of their impact on ROI ratio.

8.1. Strength and Weaknesses of RI:

- RI maximization tends to be congruent with decisions that maximise shareholder wealth
- Different notional interest rates can be set for investments of different risk levels.

BUT

- A less familiar calculation and concept
- Not good at comparing divisions of different sizes. (Larger RIs might simply be a function of bigger divisions).

Even so – residual income can still lead to viable investments being rejected due to high initial capital cost and divisional management short term thinking.

9. Economic Value Added

Economic value added (EVA) is a performance metric that is very similar in approach to Residual Income, and is defined as being:

EVA = Net operating profit after tax – WACC% x Book value of capital employed

EVA is a trade-marked technique, developed by consultants called Stern Stewart and Co.

The principle behind it is that a business is only really creating value if its profit is in excess of the required minimum rate of return that shareholders and debt holders could get by investing in other securities of comparable risk.

EVA allows all management decisions to be modelled, monitored, communicated, and compensated in a single and consistent way – always in terms of the value added to shareholder investment.

The capital employed is the opening capital employed, adjusted for the items set out below. This adjustment aims remove effect of accounting entries and other non-cash estimates.

The major adjustments are:

Add back to profits:

- Expenditure on building for the future (e.g. research expenditure, marketing expenditure and staff training):
- Non-cash expenses
- Provisions
- Goodwill written off
- Depreciation: add back book depreciation and deduct economic depreciation. If economic depreciation is not given, assume it is the same as book depreciation and that there is no net adjustment.
- Interest on debt capital

  Add back to net profit after adjusting for any tax relief.

  Treat the debt as part of capital employed

Adjustment to statement of financial position

- Non capitalized leases
- Research etc now capitalised
- Goodwill written off
- Provisions

Example 5

Extracts from the accounts of Value Co are as follows:

Income Statements:

	2014	*2013*
	$m	*$m*
Revenue	608	520
Pre-tax accounting profit (note 1)	134	108
Taxation	(46)	(37)
Profit after tax	88	71
Dividends	(29)	(24)
Retained earnings	59	47

Balance Sheets:

	2014	*2013*
	$m	*$m*
Non-current assets	250	192
Net current assets	256	208
	506	400
Financed by: Shareholders' funds	380	312
Medium and long-term bank loans	126	88
	506	400

Note: After deduction of the economic depreciation of the company's non-current assets. This is also the depreciation used for tax purposes. Other information is as follows:

(1) Capital employed at the end of 2012 amounted to $350m.

(2) Value Co had non-capitalised leases valued at $16m in each of the years 2012 to 2014. The leases are not subject to amortisation.

(3) 3Value Co's pre-tax cost of debt was estimated to be 9% in 2013 and 10% in 2014.

(4) 4Value Co's cost of equity was estimated to be 15% in 2013 and 17% in 2014.

(5) The target capital structure is 70% equity and 30% debt.

(6) The rate of taxation is 30% in both 2013 and 2014.

(7) Economic depreciation amounted to $64m in 2013 and $72m in 2014. These amounts were equal to the depreciation used for tax purposes and the depreciation charged in the income statements.

(8) Interest payable amounted to $6m in 2013 and $8m in 2014.

(9) Other non-cash expenses amounted to $20m in 2013 and $15m in 2014.

(10) Research and development expenditure on a new project started in 2013 and written off was $10 million in 2013 and $11 million in 2014

Calculate the Economic Value Added in each of 2014 and 2013.

9.1. Potential problems of EVA

- It is difficult to use EVA to compare firms or divisions because it is an absolute measure and takes no account of the relative size of the business.
- EVA may cause short term focus
- Economic depreciation is difficult to calculate and conflicts with generally accepted accounting principles.
- May ignore other relevant costs or income (those which are not in financial statements)

Chapter 6

TRANSFER PRICING

1. Introduction

When a organisation operates with a divisionalised structure – it is likely that one division may supply components or products/ services to another division, in the same company.

Because the performance of each division is measured separately then it becomes important to divisional managers that a **fair price is charged and received** for intra-divisional trade of goods and services.

In this chapter we will look at various types of transfer pricing systems, consider the effect of intra-divisional trading on goal congruence and explain the importance of 'sensible' transfer prices.

2. What is a transfer price?

The transfer price is the price that one division charges another division from the same company for goods or services supplied from one to the other. It is an internal charge – the 'sale' of one division is the 'cost / purchase' of the other. Although it will be reflected in the results for each division individually, there is no effect in the accounts of the company as a whole.

Example 1

Division A produces goods and transfers them to Division B which packs and sells them to outside customers.

Division A has costs of $10 per unit, and Division B has additional costs of $4 p.u.. Division B sells the goods to external customers at a price of $20 p.u.

Assuming a transfer price between the divisions of $12 p.u., calculate:
(a) the total profit p.u. made by the company overall
(b) the profit p.u. made by each division

3. Why have a transfer price?

Transfer pricing is needed when an organisation is structured into divisions.

And

The divisions trade between each other.

Financial performance is assessed for divisions independently –often using profit based measures - so therefore the buying division will wish to minimise costs from purchasing a transferred unit whereas the selling division will want to maximise the selling price received.

If, in the previous example, there was no transfer price and goods were transferred 'free of charge' between the division, then the **overall profit for the company would be unchanged**. However, Division A would only be reporting costs relating to that product, whereas Division B would be reporting an enormous profits (because they are able to earn sales revenue from an item that is recorded as $0 cost).

The problem would be compounded if Division A was able to sell the same product to an external market - as well as transferring to Division B.

Division A will be reluctant to trade with B if all transfers are recorded as a loss making sales.

Therefore a **'fair' transfer price** is required to record the sale and the costs in the two divisions accounts.

There are also **tax implications of transfer pricing** amongst divisions located in different tax jursidictions / different countries. The OECD produce guidelines on international transfer pricing - otherwise companies may shift profits away from countries with higher rates of corporation tax.

4. Cost-plus transfer pricing

A very common way in practice of determining a transfer price is for the company to have a policy that all goods are transferred at the cost to the supplying division plus a fixed percentage.

Example 2

Division A has costs of $15 p.u., and transfer goods to Division B which has additional costs of $5 p.u.. Division B sells externally at $30 p.u.

The company has a policy of setting transfer prices at cost + 20%.

Calculate:
a) the transfer price
b) the profit made by the company overall
c) the profit reported by each division separately

5. Goal congruence

In a decentralised divisional structure, each divisional manager will have autonomy over decision making. It will be therefore the decision of each manager, which products are worthwhile to produce in their division (for these purposes we assume that each division produces a range of products and therefore ceasing production of one product from range will not be a problem).

A cost-plus approach can lead to problems with goal congruence in situations where intercompany trading is beneficial as a whole but the selling divisional manager has no other incentive to produce a component.

Example 3

Division A has costs of $20 p.u., and transfer goods to Division B which has additional costs of $8 p.u.. Division B sells externally at $30 p.u.

The company has a policy of setting transfer prices at cost + 20%.

Calculate:
(a) the transfer price
(b) the profit made by the company overall
(c) the profit reported by each division separately
Determine the decisions that will be made by the managers and comment on whether or not goal congruent decisions will be made.

6. "Sensible" transfer pricing to achieve goal congruence.

The previous example illustrates that unless care is taken to set the transfer price sensibly, decisions may be made that are not goal congruent.

In the examination you may be asked to required to select a sensible transfer price or select a range – giving minimum and maximum acceptable prices for transfer.

There is a 'rule' that may be applied. However, we will demonstrate the logic behind the rules using a series of small examples, the rules will be then be summarised at the end.

Example 4

Division A has costs of $20 p.u., and transfer goods to Division B which has additional costs of $8 p.u.. Division B sells externally at $30 p.u.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 5

Division A has costs of $15 p.u., and transfers goods to Division B which has additional costs of $10 p.u.. Division B sells externally at $35 p.u.

A can sell part-finished units externally for $20 p.u.. There is limited demand externally from A, and A has unlimited production capacity.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 6

Division A has costs of $15 p.u., and transfers goods to Division B which has additional costs of $10 p.u.. Division B sells externally at $35 p.u.

A can sell part-finished units externally for $20 p.u.. There is unlimited external demand from A, and A has limited production capacity.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 7

Division A has costs of $8 p.u., and transfers goods to Division B which has additional costs of $4 p.u.. Division B sells externally at $20 p.u.

Determine a sensible range for the transfer price in order to achieve goal congruence, if Divison B can buy part-finished goods externally for:

(a) $14 p.u.

(b) $18 p.u.

3. The 'rule' for sensible transfer pricing

The following rule summarises the results from the previous examples:

3.1. Minimum transfer price:

3.2. Maximum transfer price:

(Note: we always assume that both divisions are manufacturing many products and that discontinuing one product will have no effect on the fixed costs. It is therefore only the **marginal costs** that we are interested in when applying the above rules.)

4. Capacity limitations

In one of the previous examples there was a limit on production in one of the divisions. This problem can be made a little more interesting, although the same rule as summarised in Section 7 still applies.

Example 8

A is capable of making two products, X and Y.

A can sell both products externally as follows:

	X	*Y*
External selling price	80	100
Variable costs	60	70
Contribution p.u.	20	30

A has limited labour available. The labour hours required for each product are X: 5 hours p.u., Y: 10 hours p.u.

A has unlimited external demand for both products.

Division B requires product Y from Division A.

Calculate the minimum transfer price that should be charged by A for supply of Product Y to Division B.

5. Other methods of Transfer Pricing.

5.1. Market price method.

Market price may be suitable if buying and selling division can buy/ sell externally at market price and selling division is at full capacity.

May encourage efficiency because divisions must compete with external competition.

May be difficult in reality there is likely to be various different market prices for a particular item and these will constantly fluctuate.

5.2. Full Cost plus

This method calculates transfer price using FULL standard absorption cost plus a mark-up for profit.

This has an advantage of being easy to calculate assuming a standard cost based on absorption costing is already used.

However, with this method, the fixed costs of the selling division actually become the variable costs of buying decision so may cause dysfunctional decisions.

5.3. Two part Tariff

This method agrees on a variable cost per unit to be used by both divisions and a lump sum is negotiated to contribute towards selling division overheads.

The variable cost will apply to each unit of transferred output – whereas the lump sum amount is likely to be paid as an annual agreement.

5.4. Dual pricing

Dual pricing is used when there is no single cost that is acceptable to the buying and selling division.

The head-office of the organisation may wish to encourage trade between divisions so they allow for dual prices to exists.

For the same item:

A higher price is used when calculating the sale in the selling division.

A lower price is used when calculating the cost in the buying division.

The differences for accounting purposes are absorbed centrally as head office overhead.

Chapter 7

FINANCIAL PERFORMANCE MEASUREMENT

1. Introduction

Financial performance of a company is crucial to the interests of shareholders, senior management, lenders, potential investors and many other stakeholder groups.

Financial statements provide the basis for much of the information but need interpretation in order to assess performance in a meaningful way.

Ratio analysis provides a useful tool for the measuring and reporting of key areas of financial performance.

All ratios and formulae must be learned and are highly examinable within Paper P2. Interpretation of the ratios and explaining their significance is equally important as the mathematical calculation.

1.1. Bases for comparison:

The result of ratios usually have little meaning when viewed in isolation, They only really take on significance when used as a comparative measure.

Depending on the information available, ratios provide more relevant insight when compared to :

- Previous years ratios (same company)
- Ratios from other similar companies
- Target ratio figures
- Industry averages

2. The main areas

The following key areas are useful ways in which to measure the performance of a company.

- **Profitability**
- **Liquidity**
- **Gearing**

Example 1

Statements of Financial Position as at 31 December

	20X7		*20X6*	
	$	*$*	*$*	*$*
ASSETS				
Non-current assets				
Tangible assets		1,341		826
Current assets				
Inventory	1,006		871	
Trade receivables	948		708	
Cash	360		100	
		2,314		1,679
TOTAL ASSETS		3,655		2,505
LIABILITIES AND CAPITAL				
Capital and reserves				
$1 ordinary shares	1,200		720	
Retained profit	990		681	
		2,190		1,401
Non-current liabilities				
10% loan 2015		500		400
Current liabilities				
Trade payables	653		516	
Tax payable	228		140	
Dividends payable	84		48	
		965		704
TOTAL LIABILITIES AND CAPITAL		3,655		2,505

Income statement for the year ended 31 December

	20X7	*20X6*
	$	*$*
Revenue	7,180	5,435
Cost of sales	5,385	4,212
Gross profit	1,795	1,223
Distribution costs	335	254
Administrative expenses	670	507
Profit from operations	790	462
Finance costs	50	52
Profit before taxation	740	410
Company tax expense	262	144
Profit after taxation	478	266
Dividends	169	95
Retained profit for the period	309	171

Discuss the performance of the business above, using calculations and ratios to comment on profitability, liquidity and gearing levels.

Profitability

$$\text{Net profit margin} = \frac{\text{Profit before interest and tax}}{\text{Revenue}}$$

$$\text{Gross profit margin} = \frac{\text{Gross profit}}{\text{Revenue}}$$

$$\text{Return on capital employed} = \frac{\text{Profit before interest and tax}}{\text{Total long term capital employed *}}$$

**Capital employed (two methods for obtaining this – depending on available information)*

Total long term capital = Non-current assets + current assets less current liabilities.

OR

= Share capital + all equity reserves + long-term liabilities

$$\text{Asset turnover} = \frac{\text{Revenue}}{\text{Total long term capital}}$$

Liquidity

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{Quick ratio (or acid test)} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$$

$$\text{Inventory days} = \frac{\text{Inventory}}{\text{Cost of sales}} \times 365 \text{ days}$$

$$\text{Average collection period (receivables days)} = \frac{\text{Trade receivables}}{\text{Revenue}} \times 365 \text{ days}$$

$$\text{Average payment period (payables days)} = \frac{\text{Trade payables}}{\text{Purchases}} \times 365 \text{ days}$$

Gearing

$$\text{Gearing} = \frac{\text{Long term liabilities (Debt)}}{\text{Shareholders' funds (Equity)}} \%$$

$$\text{Interest Cover} = \frac{\text{PBIT}}{\text{Interest charge}} \text{ times}$$

3. The Dupont relationship

Net profit margin x Asset Turnover = Return on Capital employed (ROCE)

The link between these three key ratios is required knowledge for CIMA P2 and can often be the route to obtain key data for other parts of the syllabus.

Example 2

Use the results obtained for Example 1 to prove this relationship mathematically.

4. Performance Measurements – Benchmarking & TQM

Benchmarking is a process of measuring organisational performance against that of best-in-class companies or other standards of excellence.

TQM environments use benchmarking to identify problems and improve, develop and measure their performance in key areas. By selecting 'standards of excellence' to compare against – rather than say simply an average for the industry, the TQM principle of continuous improvement can be fulfilled.

There are many different types of benchmark - some of the main ones are given below:

- **Competitive Benchmarking** - involves comparison with competitors – this data may be hard to obtain.
- **Internal Benchmarking** – comparing performance in one part of the organisation to another part.
- **Functional Benchmarking** - comparing a function or area of the organisation with the results of another organisation who are successful in that area.
- **Product Benchmarking** –comparing a product or service against that produced by competitor (may require reverse engineering).

5. Limitations of ratio analysis

Ratios are widely used for reporting performance results. They form the basis of key performance indicators (KPIs) which indicate financial health of a company. However, there are limitations to measuring performance in this way.

- As discussed, the ratios are meaningless without a comparative yardstick to measure against. Always be sure that you are comparing like with like – and that figures are prepared on same basis using uniform accounting policies.
- Statement of Financial Position values may not be representative of the overall activity of the business. These values only present 'a snap shot' of financial position at one point in time – i.e. year end and so using these for performance ratios could be misleading.
- Ratios are often based on profit which is influenced by accounting policies and other non-cash estimates (depreciation, amortisation, provisions etc). This makes profit a subjective measure – which can be indirectly manipulated by management through valuations and estimates provided.
- Financial ratios in this section are all quantitative measures and do not reflect qualitative factors which may be equally important for the success of a company.
- Financial performance metrics may provide performance targets that are too narrow or inappropriate for use, this can result in dysfunctional behaviour or demotivation amongst staff.

It is important to remember, that the success of a business cannot be measured in terms of financial data alone.

In order to get a true sense of overall company performance, a range of measures should be obtained. These should be based on financial and non-financial factors (next chapter).

Chapter 8

ALTERNATIVE PERFORMANCE INDICATORS

1. Introduction

So far we have looked at **financial performance measurements**.

As discussed, the success of a business **cannot be measured in terms of financial data alone**. In order to get a true sense of **overall** company performance, **a range of measures** must be obtained. These should include **financial and non-financial** aspects.

Modern business depends on more than just profit and cash –**non-financial qualities** are also key to the company success – if only because they drive sales and profits in the longer term.

Non-financial performance indicators that focus on customer preferences can act as **'lead' indicators**, which can provide an **early warning signal** before problems start to impact the financials.

In this chapter we look at **non-financial performance** indicators and the **Balanced Scorecard** model, which combines a **variety of measures** to report performance using a more integrated approach. In addition we consider the **three 'E's'** and **Value for Money**.

2. Non-financial performance indicators

Non-financial performance measurements enables a company to measure **any non-financial aspect** that they believe to be critical to its success.

The measures are **diverse in nature** and can be applied to any non-financial measurement that is **not expressed in monetary units** (and does not contain any monetary values in its calculation)

Popular areas for which non-financial measures are used include, **quality, customer satisfaction, operational effectiveness, staff satisfaction, innovation and environmental actions**.

For example, customer satisfaction could be measured as:

- Number of complaints per week
- % of returned goods within 14 days of sale.

The **subjective** nature of many non-financial qualities can make these aspects **harder to measure** than financials.

2.1. Advantages of Non-financial performance indicators

- Can act as **lead indicators of future performance** – providing an early warning signal before sales/ profits begin to decline.
- Can be aligned to measure **long term objectives and viability.**
- Through **improvement of non-financial performance** companies **may indirectly drive sales and profits**

2.1. Drawbacks of non-financial performance indicators

- **Time and Cost** (cost of measurement may exceed benefit.)
- Difficulty in **obtaining relevant information**
- No agreed formulae for non-financial indicators – harder to compare, dependent on timing, results are expressed in different formats (time, percentages, quantities etc).
- May be a **lack of causal link** between company efforts and certain non-financial results meaning focus can be on uncontrollable or unimportant factors.

Example 1

Suggest some Non-financial performance measurements that would be suitable for a large supermarket chain to assess their performance in the following areas.

a) To measure environmental performance

b) To measure customer service

c) To measure employee satisfaction

3. Kaplan and Norton's Balanced Scorecard

The **Balanced Scorecard** (developed by Kaplan and Norton 1992) views a business from **four perspectives** and aims to establish goals for each together with measures which can be used to evaluate whether these goals have been achieved.

The idea is this will give an **overall health check** in **four key areas** using a range of **internal** and **external, financial** and **non-financial** factors to measure success.

3.1. Possible Measures

Perspective	*Question*	*Possible Measures*
Customer Perspective	What do existing and potential customers value from us?	▸ % Sales from new customers ▸ % On time deliveries ▸ % Orders from enquiries ▸ Customers survey analysis
Internal Business Perspective	What process must we excel at to achieve our customer and financial objectives?	▸ Unit cost analysis ▸ Process/cycle time ▸ Value analysis ▸ Efficiency
Learning and Growth Perspective	How can we continue to improve and create future value?	▸ Number of new products introduced ▸ Time to market for new products
Financial Perspective	How do we create value for our shareholders?	▸ Profitability ▸ Sales growth ▸ ROI ▸ Cash flow/liquidity

Chapter 9

PERFORMANCE IN THE NOT-FOR-PROFIT SECTOR

1. Introduction

Non-profit seeking organisations are those whose prime goal cannot be assessed by economic means. Examples would include charities and state bodies such as the police and the health service.

For this sort of organisation, it is not possible or desirable to use standard profit measures. Instead (in for example the case of the health service) the objective is to ensure that the best service is provided at the best cost.

In this chapter we will consider the problems of performance measures and suggestions as to how to approach it.

2. Problems with performance measurement

2.1. Multiple objectives

Even if all objectives can be clearly identified, it may be impossible to identify an over-riding objective or to choose between competing objectives

2.2. The difficulty of measuring outputs

An objective of the health service is obviously to make ill people better. However, how can we in practice measure how much better they are?

2.3. Financial constraints

Public sector organisations have limited control over the level of funding that they receive and the objectives that they can achieve.

2.4. Political, social and legal considerations

The public have higher expectations from public sector organisations than from commercial ones, and such organisations are subject to greater scrutiny and more onerous legal requirements.

2.5. Little market competition and no profit motive.

3. Value for money

Non-profit organisations, such as the health service, are expected to provide value for money.

This can be defined as providing a service in a way which is economical, efficient and effective.

3.1. Performance should be assessed under each of these '3 E's '

- **Economy**

  Attaining the appropriate quantity and quality of inputs at the lowest cost

- **Efficiency**

  Maximising the output for a given input (or, for a given output achieving the minimum input).

- **Effectiveness**

  Determining how well the organisation has achieved its desired objectives.

C. CAPITAL INVESTMENT DECISION MAKING

Chapter 10

BASIC INVESTMENT APPRAISAL TECHNIQUES – ARR AND PAYBACK

1. Introduction

This syllabus section considers techniques designed to support **long-term decision making,** such as the selection of **capital investment** projects.

In this chapter we will look at the **basic methods** of non-discounted investment appraisal – **payback and ARR**

After this chapter, the next chapter focuses on the **technically superior** investment appraisal method known as **Net Present value (NPV)** and its related concept **IRR**.

These methods, will assist **accept/ reject project decisions** and also enable you to identify the financially best option when faced with a choice of **mutually exclusive** investment projects.

You need to be able to calculate, explain and discuss the strengths and weaknesses of each investment appraisal method.

2. Capital Investment Decisions

Example 1

What do we mean by capital investment decisions?

What are the features of this type of decision that increase the risk level?

3. Investment Appraisal Techniques

Investment appraisal techniques are used to evaluate the **financial viability** of a long-term investment project.

All techniques essentially compare the **level of project returns** against the **initial outlay required** and other **relevant costs.**

These methods provide assistance at the decision making stage – prior to project acceptance– therefore the majority of costs and revenues within the analysis are likely to be **estimated** not guaranteed outcomes.

Even so, estimates should be defensible and reasonable in the circumstances. Any assumptions made by management, in relation to forecasting should be clearly stated before a decision is made.

4. Basic Appraisal technique - ARR.

Accounting Rate of Return (ARR) is a 'basic' investment appraisal method. You need to be able to calculate and interpret ARR to appraise investment options and discuss its strengths and weaknesses as a technique, in comparison with other methods (covered later).

ARR approach is an **accounting based measure** and considers the **profitability** of an investment.

The **Accounting Rate of Return (ARR)** is stated in **percentage form** and you may have seen different formulae used to calculate this. However, CIMA's preferred method is stated below, it is referred to as the **Average investment method**.

$$\text{ARR} = \frac{\text{Average Annual Profits}}{\text{Average Investment*}} \times 100$$

$$\text{*Average investment} = \frac{\text{Intial cost} + \text{Scrap proceeds}}{2}$$

Take care if you are given **cash flows rather than profits** for this calculation- cash flows will require adjustment in order to be used in this formula. Usually a **deduction of depreciation** will **convert cashflows into 'profits'** as required by this calc.

The ARR % is then compared with a **target rate of return** to decide whether or not the investment is worthwhile.

The **target rate of return** is often the equal to the company's target Return on Capital Employed (ROCE) percentage.

Example 2

A machine will cost $80,000.

It has an expected life of 4 years with an anticipated scrap value of $10,000.

Expected profits for each year of the project duration are as follows:

1 $20,000

2 $30,000

3 $40,000

4 $10,000

Calculate the ARR of the project.

5. Strengths and Weaknesses of ARR

Strengths

- Quick to calculate
- Results given in **percentage form** which provides a relative measure and is better for comparative purposes.
- This method does include all returns and costs – so accounts for a **project's total profitability** across its full life (unlike payback next)

Weaknesses

- Does not account for the **time value of money** (more next chapter)
- **Relies on profits** not cash flows – profits are subjective and can be affected by different accounting treatments.

6. Basic Appraisal technique - Payback

The **payback** technique informs management of the **length of time** that a project must run until it **recoups the original investment in cash** terms.

The payback period (stated in years) is then compared with a **target payback period** – if the **project pays back within** than target period then the project will be **accepted**, if not then it should be rejected.

As a result, payback does tend to favour **short term projects** and those which have **high cash flows** early on. The weaknesses of the method are discussed after the exercise – however, **many companies in real life do use payback** as an **initial screening method** for projects. I.e. They will review the acceptability of a project in terms of payback first before they then pass the project on for further analysis using more sophisticated appraisal techniques.

Example 3

A machine will cost $1.2 million over its life span of 4 years. It has estimated scrap value of nil.

It is expected to produce cash savings as detailed below:

	000's
Year 0 (Now)	$1200
Year 1	$300
Year 2	$500
Year 3	$800
Year 4	$850

Calculate the payback period.

7. Strengths and Weaknesses of Payback

Strengths

- Quick to calculate
- Intuitive and makes sense to non-finance managers (good first screening method)
- Uses Cashflows (this is preferred to profits)
- Does reduce project risk by favoring short term projects that have a higher liquidity

Weaknesses

- Does not account for **time value of money** (although a discounted version of payback can be calculated).
- It ignores the total returns of the project – ie cashflows received after payback is met are effectively ignored in the analysis.
- Target payback period is arbitrary.
- May lead to excessive investment in shorter-term project.

Chapter 11

DISCOUNTED INVESTMENT APPRAISAL TECHNIQUES (NET PRESENT VALUE AND IRR)

1. Introduction

This chapter continues with investment appraisal methods– this time we look at **Net present value method** and its related concepts.

2. Discounted Cash Flow – Net Present Value

This approach uses the net cash flow projections relating to a investment decision and adjusts these to take into account the **time value of money.**

The **time value of money** is a concept that recognizes that $1 received or paid today is of greater value than $1 received or paid at a date in the future. This future value decreases more and more as time periods become further away.

The **time value of money** is incorporated into project appraisal by **discounting** future cash flows at the **company required rate of return** (sometimes referred to as **cost of capital** or the **WACC%**). Each future cash flow will then be converted to its **Present Value** – which is the amount it is worth today.

The annual discount factors can be obtained through calculation or from the **Present Value table**, which will be provided in the P2 objective test exam.

The sum of the discounted net cash flows is netted against the initial cost of the project and if the **resulting figure is positive** then the **project is viewed as financially acceptable** – whereas a **negative result** will mean the **project will be rejected.**

Net present value calculations present their final result as an **absolute figure in monetary terms** – rather than a percentage or ratio.

2.1. Interpretation of NPV calculation result:

- *** NPV > 1 (positive value)** — Project is **financially viable** and should be accepted
- *** NPV = 0** — Project cash flows meet the required rate of return for the company (it does breakeven) and will **usually be accepted**.
- ***NPV < 0 (negative value)** — Project is ***not*** **financially viable** and should be **rejected.**

Example 1

A machine will cost $80,000.

It has an expected life of 4 years with an anticipated scrap value of $10,000.

Expected net operating cash inflows each year are as follows:

1	20,000
2	30,000
3	40,000
4	10,000

The cost of capital is 10% p.a..

Calculate the Net Present Value of the investment and determine whether or not this project should be accepted.

Example 2

In the previous example, suggest other factors that need to be considered before we go ahead and accept this investment project

Advantages of NPV method

Disadvantages NPV

3. Internal Rate of Return (IRR)

One problem in practice with using a Discounted Cash Flow approach such as NPV is that it is very **hard to ascertain the true Cost of Capital** for a company.

In Example 1 , we accepted the project on the basis that the cost of capital was 10%. However, suppose the Cost of Capital was not 10% but 15%. A higher rate will discount cash flows more heavily and we would expect the resulting NPV figure to be lower. If the NPV is still positive, then we would still be accept the project – but if it was negative then we would reject it.

Because of the difficult in ascertaining the estimated cost of capital, it is useful to obtain the **breakeven rate** of return for the project i.e. the discount rate at which the project would have an NPV of zero.

The discount factor which results in the **NPV being equal to zero** is known as the **Internal Rate of Return (IRR).**

We use a method of **interpolation** which requires the project net cash flows to be discounted using **two** different discount rates, **a higher rate** and **lower rate.**

The **IRR that results is only be an approximate figure** , however, this technique works better if your two discount rates result in an NPV that is positive and one that is negative.

Example 3

Using the project cash flows and results obtained in Example 1 :

a) Calculate the NPV of the project at an interest rate of 15%

b) Estimate the IRR of the project using your results from Example 1 and part (a) applied to the formula below.

c) Explain the significance of the IRR calculated in part (b).

$$IRR \approx L + \frac{NPV_L}{NPV_L - NPV_H} \times (H-L)$$

Where:

L is lower discount rate

H is higher discount rate

NPV_L is the NPV result from discounting with lower rate

NPV_H is the NPV result from discounting with higher rate

* Note the wavy equals sign ≈ means 'approximately equal'

- Advantages of IRR

- Disadvantages of IRR

4. Discounted Cash Flow Techniques (Annuity and Perpetuities)

4.1. Annuities

NPV scenarios will usually result in different cash flows paid/received in different years – therefore, each annual total needs to be discounted separately.

However, occasionally you will encounter payments/receipts that take the form of a **constant, annual cash flow for a fixed number of years**. These are referred to as **ANNUITIES.**

An example may be a series of fixed, annual, rental payments – the rent payment will be the same value for a number of years of the project.

Finding the **present value of annuity** is faster and simpler than discounting the constant cash flows separately - on a year by year basis (although both methods will give approximately the same result).

The **discount factor for an annuity** may be calculated using the following formula:

$$\frac{1}{r}\left(1-\frac{1}{(1+r)^n}\right)$$

Where:

r = rate of discount (as a decimal)

n = number of years

Cumulative present value tables containing **annuity factors** are provided in the P2 OTQ exam. Be able to use these and calculate via the formula method too.

NB) Be aware that the annuity factor calculation **assumes that the first cash flow** will be **paid/ received at the end of year 1**- adjustments must be made , if this is not the case.

Example 5

A machine will cost $45,000 and is expected to generate $8,000p.a for the following 8 years.

The cost of capital is 15% p.a..

Calculate the NPV of the investment.

Example 6

The cost of capital is 12% p.a.

What is the present value of $20,000 that is first receivable in 4 years time and thereafter each year for a total of 10 years?

4.2. Perpetuities

If a series of identical cash flows are expected to continue **forever,** this type of cash flow is referred to as a **perpetuity.**

The **discount factor** to obtain **present value of a perpetuity** is:

$$\frac{1}{r}$$

Where

r = discount rate required (as a decimal).

(Perpetuity rates are not provided in the OTQ exam – therefore you need to remember this formula to find the present value of perpetual cash flows)

Example 7

A machine costs $100,000 and is expected to generate $12,000 p.a. in perpetuity.

The cost of capital is 10% p.a.

What is the NPV of the project?

Example 8

The rate of interest is 5%. p.a.

What is the present value of $18,000 first receivable in 5 years time and thereafter annually in perpetuity?

Chapter 12

RELEVANT CASH FLOWS IN DCF (INC. TAX AND INFLATION)

1. Introduction

So far we have looked at the **method required to discount cash flows** for investment appraisal.

However, exam questions will often test your ability to determine ***which* cash flows** to include/ exclude in your analysis.

In this chapter we discuss the principles of **relevant cash flows** and look at conventions used to account for **working capital, taxation and inflation** within investment appraisal scenarios.

2. Relevant costs

Relevant costs refer to **costs** which are **directly incurred (or saved) by the decision being made.**

As a rule they should be **Future, Incremental** and **cash based**.

In addition to **Direct Costs** we include **Opportunity costs** which represent the value of the next best alternative that must be sacrificed in order to pursue the chosen course of action.

Opportunity costs can only apply to limited or finite resources- otherwise no sacrifice results from using them.

Eg. The opportunity cost of lost contribution from transferring key sales staff to focus on a new project would be a relevant cost for the new project.

3. Non–relevant costs

Non-relevant costs are those that will **not change** as a result of the decision.

Always read the particulars of the question – but in general the following costs are **not relevant** for decision making.

- **Sunk costs** – These are costs, which have already been **paid**. Therefore they will **not change** as a result of a decision and therefore are **not relevant** when evaluating the costs of a decision. An example would be the costs of research relating to a project– these costs can not be recovered so should not be included in the decision whether to go ahead with the project.
- **Committed Costs** – these type of costs must be paid regardless of the decision. They are usually ongoing commitments – possibly lease or rental agreements that must be honoured by the business in the short term.
- **Book Values or historic costs** – these costs are usually irrelevant to a decision because they are out of date and are not a consequence of a decision being taken now.

- **Non-monetary costs** – these are accounting valuations and estimates such as depreciation and amortisation – these are not cash flows, so are seen as irrelevant for decision making.
- **Finance costs** – the cashflows relating to interest or dividend payments on the project capital is dealt with by discounting using our **cost of capital percentage so** should **not be included** in NPV calculations.

Example 1

A research project which to date has cost the company $150,000 is currently under review.

If the project were allowed to proceed, it will be completed in approximately one year, when the results would be sold to a government agency for $300,000.

Shown below are the additional expenses which the managing director estimates will be necessary to complete the work.

Materials:

The materials required have just been purchased at a cost of $60,000. They are toxic and, if not used in this project must be disposed of at a cost of $5,000.

Labour:

Skilled labour is hard to recruit. The workers concerned have been transferred to this project from a production department, and the production manager claims that if the men were returned to him they could generate sales of $150,000 in the next year. The prime cost of these sales would be $100,000 including $40,000 for the labour cost itself. The overhead absorbed into this production would amount to $20,000.

Research staff:

It has already been decided that when work on this project ceases, the research department will be closed. Research wages for the year are $60,000, and redundancy and severance pay has been estimated at $15,000 now, or $35,000 in one years time.

Equipment:

The project utilises a special microscope which cost $18,000 three years ago. It has a residual value of $3,000 in another two years, and a current disposal value of $8,000. If used in the project it is estimated that the disposal value in a years time will be $6,000.

Share of general building services:

The project is charged with $35,000 p.a. to cover its share of general building expenses. Immediately the project is discontinued, the space occupied by the project could be sub-let for an annual rental of $7,000.

Advise the managing director as to whether or not the project should be allowed to proceed, explaining your reasons for the treatment of each item.
(Ignore the time value of money)

4. Working capital

It is very common, that in addition to the **initial outlay** required at the start of an investment project, cash will also be needed immediately to finance **working capital** requirements.

The working capital requirements relate to such things as the **carrying of inventory** of raw materials and **the financing of receivables** resulting from the sales.

Unless told differently, the convention is that we assume that the working capital results in a cash outflow at the time it is needed, that the requirement remains for the place until the end of the project when it is released (and therefore results in a cash inflow).

Only **incremental increases** in working capital should be entered as cash flows in the **middle years** between start and end of working capital investment.

Example 2

A machine costs $100,000 to purchase. In addition a further $20,000 working capital will be required at the start of the project.

The project is expected to last 4 years and to have a scrap value of $20,000 at the end of its useful life.

Net operating cash flows are expected to be $30,000 p.a. for the first two years and $40,000 p.a. for the following two years.

All operating flows are to be assumed to occur at the ends of year.

Calculate the net cash flow for each of the years in question (you are not required to discount or arrive at an investment decision).

5. Taxation

When a company invests in a **profitable investment opportunity** they will incur taxation on the additional profit resulting from the project.

This extra tax payable is a **relevant cash flow** (a direct result of the decision to go ahead with the project) and therefore needs to be included in our NPV analysis.

Note that if a **new investment were to make a loss,** then the company would effectively pay less tax than before so a **tax saving** should be shown within the NPV calculation.

There are two tax affects on our appraisal.

- In each year, any extra profit will result in extra tax payable (as discussed above)
- Additionally, **the initial capital investment** is likely to result in **additional capital allowances *(tax allowable depreciation)*** being available to the company, which will result in a tax saving – shown as a cash inflow in the relevant year.

Please note that is is **always the tax saving** that is entered **into the NPV** – **not** the **tax allowable depreciation** itself.

Objective test investment appraisal questions which involve taxation will usually state the **rate of tax, how tax is payable (dates due)** and the **rate of tax allowable depreciation for the asset.** This information should be sufficient for you to enter two types of relevant cashflows to your NPV **(Tax payable on profits and tax savings from capital allowances)**

When dealing with tax in this examination we make the following simplifying assumptions:

- tax is calculated on operating cash flows (in practice it is on adjusted operating profits)
- there is no advance tax payable
- there is no tax on working capital (either the outflow or the inflow)
- there is no 'pool' of assets for capital allowance calculations – capital allowances are calculated in isolation for the investment in question
- no other taxes are relevant (e.g. capital gains tax, carry back losses etc)

Example 3

A company has a year end of 31 December each year.

It is considering the purchase of a new machine on 1 January 2003 at a cost of $10,000.

The machine is expected to generate net operating cash flows of $5,000 during the first year and $7,000 during the second year.

It is intended to sell the machine at the end of the second year for $6,000.

Additional working capital of $1,000 will be required at the start of the project.

Corporation tax is 30% payable one year in arrears.

Capital allowances are available at 25% p.a. on a reducing balance basis.

The cost of capital is 10%

Calculate the NPV of the project and advise as to whether it should be accepted or rejected.

6. Inflation

Our NPV investment appraisal calculation is based upon forecasted, future, cash flows expected to occur during the life span of our project.

For long term investment decisions, it is very likely that some of the future cash flows will be subject to inflationary increases each year.

E.g. we might need to pay rent for new premises which is *currently* $10,000 each year but which is subject to 5% annual inflation.

Within DCF calculations, we need to enter the **actual expected cash flows** that we plan to **pay or receive** so this will require us to **inflate the individual cash flows** where an inflation rate is given. This working should be done *before* entering the inflated values into the NPV for discounting purposes.

Example 4

Ventspils plc are considering buying a new machine in order to produce a new product.

The machine will cost $2,800,000 and is expected to last for 3 years at which time it will have an estimated scrap value of $1,000,000

They expect to produce 100,000 units p.a. of the new product which will be sold for $20 p.u. in the first year.

Production costs p.u. (at current prices) are as follows:

Materials	$8
Labour	$7

Materials are expected to inflate at 8% p.a. and labour is expected to inflate at 5% p.a.

Fixed overheads of the company currently amount to $1,000,000. The management accountant has decided that 20% of these should be absorbed into the new product

The company expects to be able to increase the selling price of the product by 7% p.a.

An additional $200,000 of working capital will be required at the start of the project.

Capital allowances: 25% reducing balance

Tax: 25%, 1 year in arrears

Cost of Capital: 10%

Calculate the NPV of the project and advise as to whether or not it should be accepted.

7. Inflation – Fisher Equation

The method of dealing with inflation discussed in the previous section is usually the most sensible and efficient approach. This assumes that you will be discounting the inflated cashflows using a cost of capital which also includes inflation.

However, you might be presented with the situation in which you are told the **discount rate** is a **REAL** rate (i.e. **does *not* include inflation**).

In this case **the real rate** can be used to **discount cashflows that exclude inflation**- e.g. in the NPV we can use the cashflows as quoted in 'current prices' or 'todays values' – no adjustment necessary

The same NPV will result so long as you use:

- **REAL Cashflows (today's prices**) are ***discounted*** using a **REAL cost of capital %**

Or

- **Money / Nominal cashflows** (inflated cash flows) **are *discounted* using an Nominal/ Money cost of capital %**

NB) If no information is available – then you always assume you have been given the **nominal / money cost of capital** in the question (so will be inclusive of inflation).

Objective test questions may pose a **mismatch**. For example the question details **inflated cashflows** but provides you with **a REAL rate** cost of capital or vice versa.

To add inflation to real cashflows – the process is as per previous section, bearing in mind that you may be required to inflate different cash flows (materials, labour etc) at different rates.

To add or remove inflation from the cost of capital – we require the **FISHER equation**

The **relationship** between the **nominal cost of capital and the real cost of capital** is below:

7.1. Fisher Equation

$(1+i) = (1+r)(1+h)$

where

i = nominal / money cost of capital

r = real rate

h = inflation rate

Example 5

A new machine will cost $120,000 and is expected to last 3 years with no scrap value.

It is expected that production will be 10,000 units p.a.

The selling price is $20 p.u. and the variable production costs $14 p.u. (both quoted in current prices).

Inflation is expected to be 5% p.a., and the cost of capital is 15% p.a..

Calculate the NPV of the project

a) inflating each flow and discounting at the cost of capital

b) discounting the current price flows at the effective rate.

c) why, in theory, will the decision remain the same whatever the actual rate of inflation turns out to be.

Chapter 13

DISCOUNTED CASH FLOW – FURTHER ASPECTS

1. Introduction

This chapter deals with further aspects of investment appraisal – these being capital rationing, replacement decisions, qualitative aspects and real options.

2. Capital Rationing

Capital rationing is the term used to cover the situation when the company has limited funds available for investment. This can be due to **external factors** limiting the amount that they can borrow (**hard** capital rationing) or it may be due to **internal factors** such as management's own decision to limit its borrowing **(soft** capital rationing).

In capital rationing situations, **project selection is critical** because investment **funds are limited.** There will usually be a choice of projects sometimes described as '**mutually exclusive'** meaning you only have enough resources to be able to invest in one of them.

The project that results in the **greatest total NPV** will be the best option in financial terms, however the method of determining this differs depending on the **divisibility** of the project types.

2.1. Divisible projects

If projects are described as **divisible,** it means that it is possible to invest in all of the project or just a portion of it – depending on your preferences for the capital you have available.

We assume that if we invest in (say) 10% of a project then all the flows will be 10% of the total project. E.g. you'll investing 10% of the costs and in return 10% of the inflows and savings generated will be due to you.

The resulting NPV will therefore be 10% of the full project NPV.

Selecting the project/ projections/ proportions of projects to invest the limited funds involves calculation and **ranking** of projects according to their **profitability index (PI index)** which is a ratio of the Net Present Value to the capital outlay.

Profitability index – Divisible projects only:

- Calculate the NPV per $ of initial investment (the profitability index)
- Rank the projects in terms of their profitability indexes
- Invest as much as possible in the project with the highest profitability index, then go to the project with the next highest, and so on until the capital available is exhausted.

- **Indivisible projects**

  If projects are not divisible it will only be possible to invest in whole projects.

  In this situation there is no 'quick' method – the only approach is to list all possible combinations of projects (bearing in mind the limited amount of capital available), and compare the total NPVs of each combination to select the highest.

Example 1

A company has the following 4 projects available:

	A	*B*	*C*	*D*
0	(500)	(600)	(300)	(400)
1	221	207	194	181
2	221	207	194	181
3	221	207	–	181
4	–	207	–	–
NPV @ 10%	50	57	36	50

What should the company's investment decision be if:

a) There is no capital rationing

b) Capital is restricted to $1,600 at time 0 and the projects are divisible

c) Capital is restricted to $1,600 at time 0 and the projects are indivisible.

3. Replacement

We have looked so far, at many examples where the decision was whether or not to invest in a new machine.

However, very often we may have decided to purchase a machine, but knowing that it will not last forever we have to decide **how often** to replace it.

For example, you might own a car which you expect will continue to work for 10 years before needing to be scrapped and replaced. However, the older it becomes the more expensive it will become to maintain and the lower price you will get for it when you sell it.

As a result, you may decide that it is better to replace it (say) every three years. By doing this you will avoid paying very high maintenance costs and will receive a higher sales price. The downside of course is that you would have to pay the price of a new one more frequently.

The purpose of the exercise is to determine the **optimal replacement policy.**

The approach will be illustrated using the following example.

Example 2

A machine costs $72,000 and has a maximum life of 3 years.

The running costs each year are as follows:

Year	
1	7,200
2	9,600
3	12,000

The estimated scrap values are as follows:

Year	
1	24,000
2	16,600
3	9,600

The cost of capital is 15%

How often should the machine be replaced?

Qualitative Factors in project selection.

- Each time we accept a project based on its NPV – we are saying that based on the projected cashflows and the given required rate of return – that the project is financially viable.
- Decision makers need to consider qualitative factors, which cannot be measured in financial terms.
- Qualitative factors can be equally important as financial factors in determining the project's overall success.
- Examples include, compatibility with existing operations, preferences of the workforce, quality of the product, manufacturers warranties and service levels and reliability of machinery.

4. Real Options

4.1. Introduction to real options

A **real option** relates to other alternatives presented within investment opportunities. In previous questions we have assumed that the only choice available to us is to accept or reject the project based on the expected cash flows.

However, as will be explained below, it may be possible to improve the potential return by having the ability to change something about the project during its life. This would be a '**real' option**. In the exam you are expected to be aware of the different types of 'real' options that may exist.

4.2. Types of real options

In order to explain the different types of real options, we will list them in turn together with a brief illustration of the idea.

- **Option to delay**

  Suppose we are considering a project, but the returns are uncertain because of forecast general economic problems over the next few years.

  The ability to delay starting the project could be attractive because if economic conditions turn out to be unfavourable we could cancel, whereas if they turn out to be favourable we could go ahead and maybe get even better returns.

  The fact that we would be able to remove the 'downside' risk of committing to the project now provides us with an option that may be worth paying for.

  It would effectively be a **call option** (the right to '*call in*' and invest in the project at a future date)

- **Option to abandon**

  When investment have clear, identifiable stages then investments may be staggered. At each stage management may have an option to abandon or to continue with the next stage.

  When appraising (for example) a 5 year project, we usually assume that the project lasts for the full 5 years. However, if the cash flows turned out to be lower than expected, we may wish to consider stopping the project at the next convenient point.

  Yet again, this right would effectively be an option – although this time a **put option** (giving them the right to exit at some point in the future)

- **Option to switch / redeploy**

  This presents the option to redeploy the use of assets if market conditions should change.

  For example, a small college may have decided to invest a considerable amount in equipment, staff, training etc. to commence teaching CIMA courses, on the basis that currently they appear to be the most profitable use of the resources. However, market conditions may change and it could be beneficial to effectively stop the project earlier than planned and use the resources to teach another type of qualification.

  This ability would also be a **put option.**

- **Option to contract or expand.**

  This represents the opportunity to increase investment size or reduce the level of investment later into the project.

Chapter 14

PRICING

1. Introduction

Selling price is one of the key decisions for those who trade in goods and services.

If **selling price is set too high** then demand may not be sufficient to make a profit.

If **selling price is too low then** demand may exceed supply – and we may also have forgone the opportunity make a greater profit through charging a higher selling price.

There are **many factors** which influence the selling price and the **particulars** of each scenario (e.g. industry, product type, level of competition etc.) require different pricing strategies.

These strategies are discussed below along with some key terms and calculations required for pricing related questions.

2. Factors influencing selling price

Many factors are relevant when considering deciding on selling price.

Example1

List as many factors as you can think of that could influence the selling price of a product.

2.1. Many of the selling price influencers will fall into these three categories.

- **Costs**
- **Competitors**
- **Customers**

3. 'Cost' plus pricing

For **cost-plus pricing**,:

Selling Price = Cost per unit + Profit %

Which cost? Which profit?

A primary consideration will be as to which '**cost per unit'** to use – i.e. full cost, marginal cost, or opportunity cost.

The **profit** added may be calculated using **mark-up or margin** – be sure to familiarise yourself with these calculations from previous studies.

3.1. Full cost plus

Full cost includes a share of overheads and also often includes non-production costs.

- **Advantages**

- **Disadvantages**

3.2. Marginal cost plus

For **marginal cost-plus pricing**,:

The selling price here is determined by calculating the **marginal (**or incremental) cost of producing a unit and adding a mark-up.

- **Advantages**

- **Disadvantages**

3.3. Opportunity cost plus

This is a marginal cost approach but also includes within the cost any opportunities foregone. It is a relevant costing approach.

Example 2

A new product is being launched, and the following costs have been estimated:

Materials	$10 per unit
Labour	$8 per unit
Variable overheads	$5 per unit

Fixed overheads have been estimated to be $50,000 per year, and the budgeted production is 10,000 units per year.

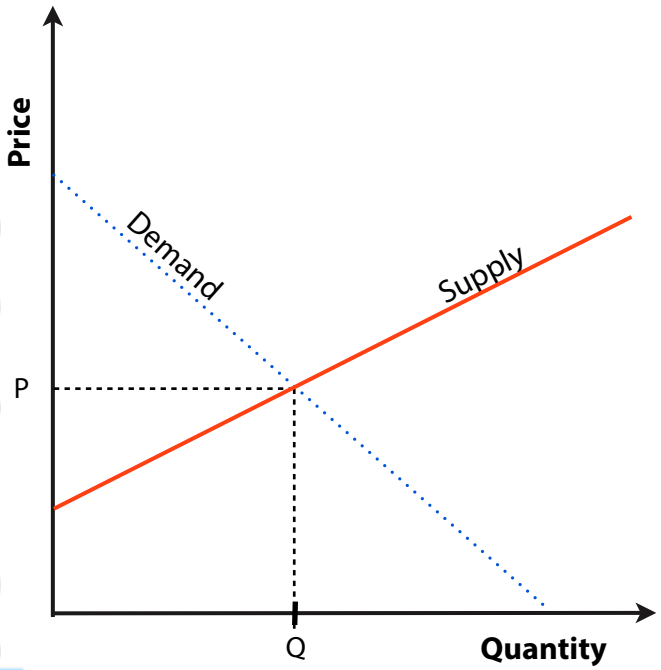
Calculate the selling price based on:
(a) full cost plus 20%
(b) marginal cost plus 40%

4. Pricing – Economists viewpoint

We are going to look at the price and quantity relationship using Economic theory.

Economic theory states that for a **normal good**, the higher the selling price, the lower quantity that will be demanded.

This **inverse relationship** forms the the basis of a **normal demand curve**



The equation of a demand curve is

P = a –bQ

Where

P is selling price

Q is quantity demanded at that price

a is theoretical maximum price (if the price is set at 'a' or above, then the demand will be zero) *[the vertical axis intercept]*

b is the $\frac{\text{change in price}}{\text{change in quantity}}$

b is the gradient of the demand curve

'a' can be obtained through process of elimination or derived using formula below:

$$a = \$\text{Current price} + \left[\frac{(\text{current quantity at current price})}{\text{change in qty when price changes by \$x}} \times \$x\right]$$

NB) $ x is the ***change*** in price (not its absolute value)

You may be required to derive the 'demand equation' using information from a short scenario.

Example 3

A company sells an article at $12 per unit and has a demand of 16,000 units at this price.

If the selling price were to be increased by $1 per unit, it is estimated that demand will fall by 2,500 units.

On the assumption that the price/demand relationship is linear, derive the equation relating the selling price to the demand.

5. Profit Maximising Price / Output level

There are two methods that can be used to obtain the profit maximising price and associated quantity.

- Tabular approach
- Algebraic approach

5.1. Tabular approach

For this you need to use the information given in the question scenario to **create a table** showing costs and revenues at a range of selling prices.

Once tabulated the optimal selling price will be the one at which profit is highest.

Example 4

Kennedy plc has established that the price demand relationship is as follows:

S.P. p.u.	*Demand*
16	100
15.5	200
15	300
14.5	400
14	500
13.5	600
13	700

Kennedy have also established that the cost per unit for production:

Quantity	*Cost p.u.*
100	14.0
200	13.9
300	13.8
400	13.7
500	13.6
600	13.5
700	13.4
800	13.3
900	13.2

Complete the table – using the headers below to find the optimal selling price (profit maximising price).

S.P. p.u.	*Demand*	*Cost p.u.*	*Total Revenue*	*Total cost*	*Total profit*	*Marginal Revenue*	*Marginal Cost*

5.2. Algebraic approach (MC = MR)

Having identified the price/demand relationship, it is easy to derive the equation for the revenue at any level – the **Total revenue will be equal to Price x Quantity.**

Our objective is to maximise profit.

Economic theory tells us that – in a monopoly - profit will be maximised at the point where

Marginal Cost = Marginal Revenue

MC = MR

- Marginal cost (MC) usually equals variable cost per unit
- Marginal Revenue MR = a -2bQ < this is obtained via demand curve function

By obtaining these MC and MR and equating them – we are able to solve for Q – which is the profit maximising quantity.

In order to find profit maximising price – you need to use the demand function to find price P at the given value of Q

Example 5

Oggi Co manufacture an item G which has an estimated demand curve of P=300-0.004Q. The variable cost of each G is $40.

Use this information to find the profit maximising selling price for one unit of G.

6. Price elasticity of demand

For normal goods, a rise in price will see a fall in demand (vice versa). This is true of many products, but ***the effect*** of selling price on demand will be different for different products.

A measure of the responsiveness of demand to a change of price can be calculated as below:

$$\text{Price elasticity of demand (PED)} = \frac{\text{Change in demand as \% of original demand}}{\text{Change in price as a \% of original price}}$$

A high PED means that the demand is very sensitive to changes in price, or **elastic**.

A low PED (less than 1) means that the demand is not very sensitive to changes in price, or **inelastic**.

Example 6

Using the figures from Exercise 4 , to calculate the price elasticity of demand
a) if the current selling price is $16 per unit
b) if the current selling price is $15 per unit

7. Pricing strategies

Sometimes pricing decision represent a sales strategy – for example to gain market share or to damage the revenues of a competitor.

The **following strategies are mentioned specifically** on the **CIMA P2 syllabus** – you need to be able to

(1) **Explain their meaning**

(2) Consider the **financial consequences** of each

(3) **Suggest scenarios** for which they may be suitable.

- Penetration pricing
- Market skimming
- Loss leaders
- Product bundling / optional extras
- Product differentiation
- Other pricing strategies
  - Price discrimination
  - Premium pricing
  - Psychological pricing
  - Predatory pricing

D. RISK AND CONTROL

Chapter 15

INVESTMENT APPRAISAL UNDER UNCERTAINTY

1. Introduction

Long term decisions such as investment appraisal are subject to **uncertainty.** Regardless of your method of appraisal (payback, NPV and so on) the figures used in your analysis will based on **projections or estimates**. They are by definition, **future based** values so **cannot be known with certainty.**

There is always a **risk that estimates will not conform to financial reality**.

Ultimately, if some of the projected cash flows used in the decision turn out to be different from what was estimated, the decision itself may no longer be valid.

In this chapter we will look at **various approaches** that are can be used to reflect uncertainty within investment appraisal.

Further techniques relating to risk and uncertainty within business decision-making will be discussed in later on in this course**.**

2. Sensitivity analysis

- **Sensitivity analysis** can be useful to appraise investments or other decisions for which the **outcome is dependent** on a number of **uncertain input variables.**

  For example, a decision to invest in a new machine is likely to be based on estimated variables such as level of sales demand, estimated labour hours, estimated selling price etc.

- **Sensitivity** measures the **responsiveness to *changes*** in project variables. This allows us to determine **how crucial** the various estimates are on the accept/ reject decision.

  By considering the sensitivity of each input variable, in isolation, we can ascertain which variables which are **critical to project success.** When variables are shown to be **highly sensitive** then the investment decision would actually be changed (from accept to reject) if there happens to be just a small movement in the estimated cash flows relating to that variable.

All estimates need to be reasonable, defensible and based on robust forecasting methods. However, any variables deemed as **critical variables** will be subject to extra scrutiny before acceptance.

Sensitivity analysis requires an NPV calculation to base its analysis on.

From the NPV, we **identify all input variables** on which the NPV total is **dependent.**

We then calculate , one by one, the **% change that would be required by each variable to result in a overall NPV of zero** (i.e. breakeven point) This is significant because any changes that cause the NPV to fall *to less than zero* - would change the decision from accept to reject.

Example 1

Daina has just set up a new company and estimates that the cost of capital is 15%.

Her first project involves investing in $150,000 of equipment with a life of 15 years and a final scrap value of $15,000.

The equipment will produce 15,000 units p.a. generating a contribution of $2.75 each. She estimates that additional fixed costs will be $15,000 p.a..

(a) Determine, on the basis of the above figures, whether the project is worthwhile

(b) Calculate the sensitivity to change of:

- **i. the initial investment**
- **ii. the sales volume p.a.**
- **iii. the contribution p.u.**
- **iv. the fixed costs p.a.**
- **v. the scrap value**
- **vi. the cost of capital**

(c) Comment on the results

Advantages of Sensitivity Analysis
Disadvantages of Sensitivity Analysis

3. Monte Carlo Simulation

Simulation is a technique, which in contrast to sensitivity analysis, can look at the effect of changes to more than one variable at the same time.

Used in investment appraisal Monte Carlo simulation software, will produce a range of NPV outcomes based upon a distribution array of results for a decision that has numerous input variables and different levels of uncertainty affecting each.

You will not be required in the examination to actually perform a simulation, but you should be aware of the principle involved.

3.1. Essentially, the stages are as follows:

- identify the major variables
- specify the relationship between the variables
- attach probability distributions to each variable and assign random numbers to reflect the underlying probability distribution
- simulate the environment by generating random combinations
- record the outcome of each simulation result.
- repeat the simulation many times to be able to obtain a probability distribution of the possible outcomes

4. Expected values

With this approach, we weight the uncertain variables with the associated probability relating to each estimated value.

Then for each variable, we calculate a total weighted average outcome (or expected value), which is then entered into the investment appraisal calculation.

Example 2

Daiga plc is considering launching a new product.

This will require additional capital investment of $200,000.

The selling price of the product will be $10 p.u.. Daiga has ascertained that the probability of a demand of 50,000 units p.a. is 0.5, with a probability of 0.4 that it will be 20% higher, and a 0.1 probability that it will be 20% lower.

The company expects to earn a contribution of 50% and expects fixed overheads to increase by $140,000 per year.

The time horizon for appraisal is 4 years. The machine will be sold at the end of 4 years for $50,000.

The cost of capital is 20% p.a.

a) Calculate the expected NPV of the project

b) Assuming that the demand is certain at 50,000 units p.a. what is the NPV of the project if fixed overheads are uncertain as follows:

Fixed overheads	*Probability*
100,000	0.20
140,000	0.35
180,000	0.25
220,000	0.20

5. Standard Deviation - NPV.

When dealing with risk of a particular investment project. It can be useful to measure how wide ranging the potential outcomes may be.

Standard deviations compares all possible outcomes to the mean average (or expected value) figure.

It's a measure of dispersion and informs us how far on average do the potential outcomes differ from our mean outcome.

The higher the standard deviation – the more spread out the individual values will be from their mean. High standard deviation therefore represents higher variability in potential outcomes – so higher risk.

For example – project A and project B both have an expected NPV or mean of $40,000.

Project A has a standard deviation of $2000

Project B has a standard deviation of $6500

This means that project A's NPV is likely to be much closer to the mean of $40,000 than is the NV of project B.

The formula for standard deviation is below:

$$SD = \sqrt{\sum \left(x - \bar{x}\right)^2 P}$$

When calculating standard deviation where expected value is $\bar{X}$ – the method follows a columnar format.

Example 3

The following are likely returns from project Z.

Return	Probability
10%	0.2
15%	0.5
20%	0.3

Calculate the expected value and the standard deviation for project Z.
What is the co-efficient of variation in this case?

NB) Coefficient of variation = $\frac{\text{Standard Deviation}}{\text{MEAN}}$

6. Value at Risk (VAR)

Investors may be concerned about the likelihood of losing money.

VAR is reflects this concern and asks ' How much could be lost by an investment during a period of time'. The period of time is known as a holding period and is usually one to ten days)

VAR effectively measures the amount that is at risk of being lost from an investment – under usual conditions during a given holding period, at a particular confidence levels.

Confidence levels are usually set at 95% to 99%, eg – at a 95% level the VAR will show the amount that has a 5% chance of being lost during the period.

Example 4

A bank has estimated that the expected value of its portfolio in 2 weeks time will be $100 million, with a standard deviation of $5 million

Estimate the value at risk at a 95% confidence level.

7. Risk-adjusted discount rate

The risk inherent in a project depends very much on context of the investment. For example, risk levels will depend on factors such as the strength of competition, the type of investment, the market volatility etc.

Some projects may be higher risk than others, for example acquisition of a foreign business is likely to be higher risk than an expansion of existing domestic operations.

Note, that higher risk does not mean that the project is automatically worse –the foreign acquisition might give a much higher return, but equally there is the risk of it yielding a low or negative return.

One approach to dealing with this is to **discount higher risk projects using a higher cost of capital** – often adding an arbitrarily calculated premium to the original discount rate, to represent risk.

Although all people have different attitudes to risk, it is generally the case that **rational investors** will only be prepared to accept projects with **higher risk when the expected return is higher.**

This method reflects this rationality, because higher risk projects will be required to make greater returns in order to result in acceptance, based on new risk-adjusted higher hurdle rate.

Chapter 16

RISK AND UNCERTAINTY

Exam Focus
This topic represents 15% of the new CIMA P2 syllabus.
Many of the techniques will be familiar to you from the earlier paper CIMA P1.
This area lends itself well to objective style questions, which can take a variety of formats – therefore, practice in this area is essential!

1. Introduction

Business decision-making often requires choices to be made now about future outcomes, which are unlikely to be known with certainty.

Key decisions such as new product launches, capital investments and other opportunities are usually made without guarantee of future results.

Risk exists whenever actual outcomes of a decision may not be in line with the forecasted or expected outcomes. This will mean that results will be different than planned or hoped for.

2. Risk Vs Uncertainty

The terms risk and uncertainty are often used interchangeably but there is a technical difference:

Risk differs from uncertainty in that risk can be *quantified*. For example – we do not know what the result will be from a roll of a dice – but we do know it can only be one of six possible outcomes.

Uncertainty exists when there are no such 'well defined' possible outcomes. The outcomes are not known or quantifiable in the same way as risk. This means probabilities cannot be used as a basis for predictions.

3. Risk profiles

The approach taken to decision- making may be influenced by the decision-makers attitude to risk.

A risk seeker will be interested in the best possible outcome, no matter how small the chance that they may occur. This is described as an optimistic attitude, which may be considered reckless if likelihood of outcomes are ignored.

Someone who is **risk neutral** will be concerned with the most likely or 'average' outcome. They balance risk with reward. The average figure is often represented by the **Expected Value.**

A **risk averse** decision maker dislikes risk and when faced with two choices they will select the **least risky** option even if the associated return is expected to be lower.

4. Decision Making Techniques (Risk and Uncertainty)

For the examination you are expected to be aware of, and to apply, several different approaches when dealing with risk and uncertainty within the decision making process.

- Expected values
- Decision Rules (Maximax, maximin, minimax regret)
- Decision Trees
- Sensitivity Analysis
- Standard deviation

In earlier chapters we have applied the techniques of **expected value, sensitivity analysis** and **standard deviation** to **Investment appraisal decisions** specifically. Here we revisit these techniques and apply them to other decision making areas.

5. Expected Values

Expected Values can be obtained when in situations which have various possible outcomes for which the probabilities of each are known.

The expected value represents a *long run average result* that the decision maker could expect if the event were repeated numerous times.

$EV = \Sigma px$

Example 1

The outcome of a new venture has been forecast below.

Probability of $50,000 profit = 0.3

Probability of ($20,000) loss = 0.7

What is the expected value of this project?
Should the decision maker go ahead with the venture?

Limitations of Expected Value Method.

Expected value method is often the approach of a risk neutral decision maker. However there are some serious limitations of this method.

6. Decision Rules

Given a range of possible outcomes (usually profits or payoffs) examination questions may ask you to identify the decision that would be chosen by the decision making criterion below.

Maximax – represents the choice of an optimist who will prefer the option that results in the best possible returns regardless of likelihood.

Maximin – this pessimistic decision maker considers the worst result of all available options and seeks to minimise this. Therefore maximin option will choose the option that gives the best of the worst outcomes.

Maximin Regret – this represents the choice of a 'sore loser'. They seek to minimise the maximum possible 'regret' from all the options available.

Example 2

John has a factory capacity of 1,200 units per month.

Units cost him $6 each to make and his normal selling price is $11 each. However, the demand per month is uncertain and is as follows:

Demand	*Probability*
400	0.2
500	0.3
700	0.4
900	0.1

He has been approached by a customer who is prepared to contract to a fixed quantity per month at a price of $9 per unit. The customer is prepared to sign a contract to purchase 300, 500, 700 or 800 units per month.

The company can vary production levels during the month up to the maximum capacity, but cannot carry forward any unsold units in inventory.

a) Calculate all possible profits that could result from the various demand levels.

b) Determine for what quantity John should sign the contract, under each of the following criteria:

- **(i) expected value**
- **(ii) maximin**
- **(iii) maximax**
- **(iv) minimax regret**

c) What is the most that John would be prepared to pay in order to obtain perfect knowledge as to the level of demand?

7. Decision Trees

A decision tree is a diagrammatical representation of the various alternatives and outcomes. It is relevant when using an expected value approach and where there are several decisions to be made – it makes the options more understandable.

Conventional notations include

Squares represent decisions

Circles represent outcomes.

Lines link decisions to the potential outcomes showing the sequence of possibilities from left to right. Probabilities and costs are written along the corresponding lines. Values associated with choices and outcomes (e.g. associated profit/ contribution / costs) are written at the end of each path.

Example 3

Combi plc are having problems with one of their offices and have decided that there are three courses of action available to them:

(a) shut down the office, raising proceeds of $5 million

(b) have an expensive refurbishment of the office costing $4,000,000

(c) have a cheaper refurbishment of the office at a cost of $2,000,000

If they do the expensive refurbishment, then a good result will yield a return of $13,500,000 whereas a poor result will yield a present value of only $6,500,000.

If they alternatively decide to do the cheaper refurbishment, then a good result will yield a return of $8,500,000 whereas a poor result will yield $4,000,000.

In either case, the probability of the refurbishment achieving a good result has been estimated to be 2/3.

An independent company has offered to undertake market research for them in order to identify in advance whether the result of refurbishment is likely to be good or poor. The research will cost $200,000 and there is a 68% probability that it will indicate a good result.

Unfortunately, the research cannot be guaranteed to be accurate. However, if the research indicates a good result, then the probability of the actual result being good is 91%.

If the survey indicates a poor result, then the probability of the actual result being good is 13%.

Combi have already decided that if they do have market research, and if the research indicates a poor result, then they will only be prepared to consider the cheaper refurbishment.

Use a decision tree to recommend what actions should be taken.

Note: In this example, the market research is not guaranteed to be accurate. This is likely to be the case in real life and is an example of **imperfect information.**

8. Sensitivity Analysis

We have seen in a previous chapter that sensitivity analysis can be used to inform our investment appraisal decision.

This technique can also be applied to other areas of business decision making, where the outcome is dependent on a number of uncertain input variables.

For example, a decision to launch a new product is likely to be based on estimated demand levels, estimated selling price, estimated variable costs etc.

Sensitivity analyses the *effect of changes* made to each variable, in order to determine their effect on the decision.

As with our previous application of this method – by considering the sensitivity of each input variable we can ascertain which variables are the most **critical** and therefore perhaps need more work confirming our estimates.

Example 4

Harry is about to consider a new business opportunity.

Based on his current estimations – the opportunity looks profitable.

His forecasted sales revenue is $30,000 per year – based on 1000 units sold.

His accountant has helped him to estimate fixed costs of $15,000 p.a.

The variable costs per unit are likely to be $10 per unit.

a) Confirm, on the basis of the above figures, that the new opportunity is worthwhile

b) Calculate the sensitivity to change of:

- **i. Sales Revenue (selling price)**
- **ii. Sales volume**
- **iii. Total variable costs**
- **iv. Fixed costs**

c) Comment on the results

Chapter 17

RISK MANAGEMENT

1. Why incur risk?

- Accepting and managing risk effectively can enhance **short and long term profitability**.
- Controlled risk taking can provide a source of **competitive advantage.**
- The **greater the risk, the greater the rewards** – returns tend to be higher on riskier projects.
- **Note** that the rewards may be financial in nature- eg increased profits or decreased costs – or may be intangible such as better quality information or increased innovation.

2. Risk management responsibilities

- Risk can adversely affect the achievement of the entity's objectives
- By reducing the likelihood of an event, or its potential impact, the risk is managed.
- Managing risk is a key management responsibility and an effective risk management system is a fundamental requirement of best practice corporate governance.

3. Risk Management Process

Managing risk involves the identification and assessment of risks. The setting of risk policy, determination of risk responses and the reporting of risks.

There are many approaches to managing risk, notably :

- COSO Committee of Sponsoring Organisations ERM framework
- CIMA risk management cycle.

The advice below follows '**Risk Management: A Guide to Good Practice', CIMA (2002)**

Identify risk areas

- Analyze and evaluate risks through process of identification, description and estimation.
- Approach should be methodical - all risk types should be considered – a thorough knowledge of entity is required including up to date information on its competitors, industry, products, organisational structure and so on.
- Identification process can be undertaken through risk workshops, benchmarking, what if analysis, consultations with stakeholders .
- Assessment usually relies on a process of risk mapping (impact/ likelihood matrix)
- Risks identifed should be displayed in a structured format - eg in table .
- A risk register which includes all details of risks is recommended.

Risk Management Policy

- Determine Risk Appetite. This will be influenced by type of organisation, its size, industry, culture and resilience to withstand adverse occurrences.

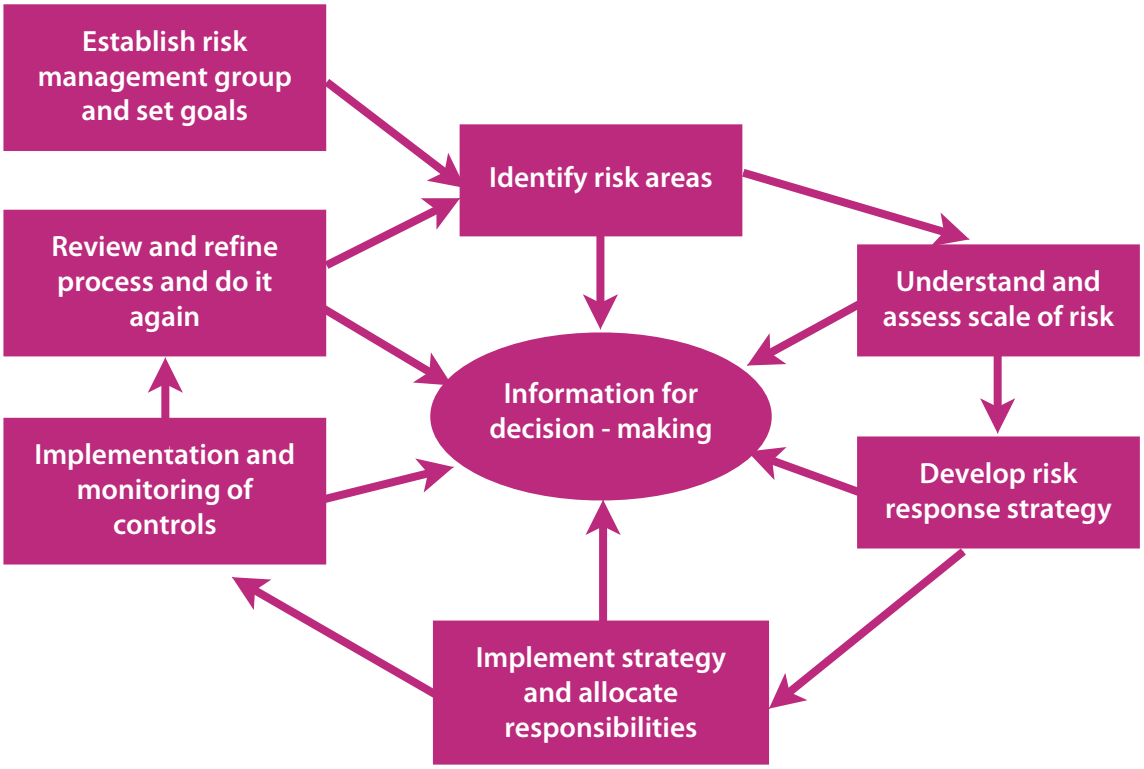
Risk Responses.

- This is the process of selecting and implementing measures to manage risk.
- These generally take the form of TARA framework – discussed later.
- They should include contingency and avoidance plans.
- Recommendations for implementation should be part of the risk response.
- This process should be ongoing –evaluate responses, monitor, re-analyse and so on.

Risk Reporting

- This will include internal and external reporting of risks.
- Should meet the requirements of corporate governance code.
- There should be information reported on Residual Risk.
- Reporting should provide assessment of Residual Risk –these are risks that can not be managed. This involves comparison of Gross Risk (assessment of risk before risk responses are applied) and Net risk (the risk that remains following the risk responses).

CIMA's Risk Management Cycle.



4. Types of risk

There is no single system of risk categorisation and the nature of the risks will ultimately depend on the entity and the factors involved.

Remember risks can be:

- **Upside Risks.**

- **Downside Risks.**

4.1. Risk categories:

Risk categories such as those given below, can be useful to group similar risk types – however not every risk will fall into a specific category.

- **Strategic Risk –** Risk of failure of business strategies – eg failed product launch.
- **Operational Risk –** Risk of business failure or poor operational processes.
- **Product Risk –** Risk that product range may fail to sell –due to loss of interest or other factors.
- **Market risk** – risks associated with the sector or industry in which the entity operates
- **Credit risk** – relates to the credit rating of the business, and therefore its ability to raise finance
- **Liquidity risks** – the risk of being unable to meet debts as they fall due because of insufficient cash
- **Technology Risks** – relates to the risks associated with technological change or failure that affects the entity or its products.
- **Political, Legal, Regulatory** risk – risk associated with the need to comply with law and regulation
- **Environmental risk –** risks occurring from environmental related issues.
- **Corporate Reputation risk** – the possibility of damage to the entity's image arising from poor performance or adverse publicity –
- **Product Reputation risk –** the effects of a change in the perception of a products image.
- **Commodity price risk** – the effects of a price rise in a commodity such as oil
- **Contractual Inadequacy risk** – The risk that contract terms are insufficient to meet all potential outcomes.
- **Fraud risk** – Impact of fraudulent activity on the business
- **Employee Risks** – staff related risks including employee error, malicious damage, employee malfeasance.

5. Risk Assessment

- **Risk mapping** is a way to analyse and evaluate risks and facilitates planned responses.
- All the risks identified in the previous stage of the process will need to be assessed in terms of the **likelihood / probability of occurrence** and **their potential impact or consequences** if they do occur.
- Probability of occurrence may be deemed as "high" or "low" (highly likely to occur or low likelihood) and the consequences/ impact will also be assessed as high or low (high impact/ low level impact).
- A matrix can be prepared showing the **four possible combinations** of "high" / "high", "high" / "low" etc
- Risks deemed as **"highly probable" with "high impact"** will become **priority** – these need urgent attention / immediate action in order to manage the risk
- Risks which are "**high" probability, but "low" impact**, need to be monitored, and the entity needs to prepare to meet the change
- **A"low" probability, "high" impact** combination need to be considered and at the very least, a **contingency plan**
- A "**low" probability and "low" impact** may not need action but **should be monitored** and regularly reassessed incase the factors change in terms of likelihood or impact.

		IMPACT / CONSEQUENCE	
		HIGH	**LOW**
PROBABILITY	**HIGH**	AVOID	REDUCE
	LOW	TRANSFER	ACCEPT

Potential responses to risk according to their placement on the risk matrix can be remembered as **TARA:**

- **Transfer** – where possible share the risk or transfer to others – eg insurance
- **Avoid** – risks that are highly likely and have high adverse consequences should be avoided where possible.
- **Reduce** – refers to methods to reduce the impact or likelihood of these risks.
- **Accept** – is an appropriate response to small low impact , low likelihood risks where a cost benefit exercise has shown that active management of these factors is not worthwhile.

Example 1

Birdy Co need to evaluate the risks related to a new business venture in a foreign country. They wish to use Risk mapping and TARA framework to formulate an appropriate response to these risks.

a) Suggest some risks that the new foreign business venture may create.
b) Assess these risks in terms of probability and likelihood and then formulate a response using TARA framework.

6. Stress Testing

Businesses can conduct stress test to analyse how well they can cope in the event of adverse changes or under different conditions.

Stress testing may be used to hypothesise how a business might cope in the event of a cyberattack for example – or an economic downturn.

Robert Simons, a Harvard Business professor suggested questions that directors can ask to determine is their business is robust.

Amongst these he recommended matters such as:

Prioritisation - Who is your primary customer? Once identified the majority of resources should be directed to support their needs.

Measurement- What critical performance variables are you tracking? What metrics matter most to your business – these should be based on key factors which drive performance.

Productivity – are you generating 'creative tension'. This s the idea that disagreement which challenges the norms should be encouraged and will produce new ideas.

Flexibility – this is key, rapid changes in technology

7. Ethical Threats

CIMA's code of ethics consists **of five fundamental principles**:

- **Integrity**
- **Objectivity**
- **Professional competence and due care**
- **Confidentiality**
- **Professional Behaviour.**

*** These can be remembered using the mnemonic OPPIC.**

As a management accountant – these principles must be complied with in all of your actions and perceived actions.

Ethical risks are managed and dealt with through applications of **appropriate safeguards.**

8. Safeguards from within:

- **The profession**
  - Education and training, including cpd requirements
  - Setting corporate governance regulations and professional standards
  - Monitoring of the quality of professional work and applying disciplinary proceedings when appropriate
- **The entity**
  - Internal control systems
  - Review procedures
  - Disciplinary procedures
  - Entity's own code of ethics
  - Separate review and reporting in key areas
- **The individual**
  - Compliance with professional standards
  - Maintenance of records of contentious issues
  - Mentoring
  - Contacting CIMA with ethical dilemmas

Ethical threat	Safeguard
Conflict between requirements of the employer and the fundamental principles For example, acting contrary to laws or regulations or against professional or technical standards	▸ obtaining advice from the employer, professional organisation or professional advisor ▸ the employer providing a formal dispute resolution process ▸ legal advice
Preparation and reporting on information Accountants need to prepare/report on information fairly, objectively and honestly However, the accountant may be pressurised to provide misleading information	▸ consultation with superiors in the employing entity ▸ consultation with those charged with governance ▸ consultation with the relevant professional body
Having sufficient expertise Accountants need to be honest in stating their level of expertise – and not mislead employers by implying they have more expertise than they actually possess Threats that may result in lack of expertise include time pressure to carry out duties, being provided with inadequate information or having insufficient experience	▸ obtaining additional advice/training ▸ negotiating more time for duties ▸ obtaining assistance from someone with relevant expertise
Financial interests Situations where an accountant or close family member has financial interests in the employing entity Examples include the accountant being paid a bonus based on the financial statement results which he is preparing, or holding share options in the entity	▸ remuneration being determined by other members of management ▸ disclosure of relevant interests to those charged with governance ▸ consultation with superiors or relevant professional body
Inducements – receiving offers Refers to incentives being offered to encourage unethical behaviour Inducements may include gifts, hospitality, preferential treatment or inappropriate appeals to loyalty Objectivity and/or confidentiality may be threatened by such inducements	▸ Do not accept the inducement! ▸ Inform relevant third parties such as senior management and professional association (normally after taking legal advice)
Inducements – giving offers Refers to accountants being pressurised to provide inducements to junior members of staff to influence a decision or obtain confidential information	▸ Do not offer the inducement! If necessary, follow the conflict resolution process outlined in the previous section

Confidential information Accountants should keep information about their employing entity confidential unless there is a right or obligation to disclose, or they have received authorisation from the client However, the accountant may be under pressure to disclose this information as a result of compliance with legal processes such as anti–money laundering / terrorism – in this situation there is a conflict between confidentiality and the need for disclosure	▸ Disclose information in compliance with relevant statutory requirements, eg money laundering regulations
Whistle-blowing Situations where the accountant needs to consider disclosing information although there is no obligation from statute or regulation Disclosure would therefore be in the public interest	▸ Follow the disclosure provisions of the employer, eg report to those responsible for governance ▸ Otherwise disclosure should be based on assessment of: • legal obligations • whether members of the public will be adversely affected • gravity of the matter • likelihood of repetition • reliability of the information • reasons why employer does not want to disclose

Chapter 18

DATA COLLECTION AND USE OF INFORMATION

1. Introduction

This chapter considers the costs, benefits and potential risks relating to the collection and use of information.

It discusses the types of information systems and we also look at costs and benefits of investing in information systems and the concept and potential uses of 'Big Data'.

2. Business intelligence tools

Information systems refer to the various components of hardware, software, databases and network connections that the organisation can use to process, create, distribute and report data.

- **Transaction processing systems** (TPS)

  This is a system that collects, stores and processes the day-by-day transactions of the business.

  For example, the process of recording sales orders onto the system.

- **Management information systems** (MIS)

  MIS systems convert data (captured by the transaction processing system) into meaningful information for the benefit of management.

  For example, for example, the sales data recorded may be transformed into analysis of sales by product or by customer group. These reports are often automated and produced regularly.

- **Decision support systems (DSS)**

  DSS help managers to cope with unstructured decisions such as what should next year's budget show. It combines the use of modelling and analytical techniques to data held and new information. Projections of revenue based on certain product / sales assumptions are a good example.

- **Executive information system (EIS)**

  An EIS system enables the user to undertake business modelling and obtain summary and detailed information from internal and external sources that are relevant to the organisational goals.

  The design of these enables managers to 'drill down' and access the data which supports the summary information.

- **Enterprise resource planning systems (ERP)**

  An enterprise resource planning system is software that integrates all the information within the business and uses a common database. For example, it may combine all

information on sales, manufacturing, purchasing, payroll HR and accounting data in order to facilitate information flow and provide insight relating to the core business processes.

- **Expert Systems**

  Expert systems hold specialist knowledge and are created to simulate the judgement and behaviour of a human or organisation that has expertise in a particular field.

  Expert systems have been used for medical diagnosis allowing patients to cross reference their symptoms against a database of expert knowledge supported by probabilities and real time updates to increase the accuracy of decisions made.

Additional note:

Business intelligence is more than just the hardware and software of an organisation. It is about a company wide recognition that data collected is an extremely valuable asset to the company. If used to its full potential, it can provide a powerful tool for decision making and a basis for management to implement change.

3. Risks of Information

Information systems and electronic data bring with them specific as well as general risks which need to be controlled and reduced to an acceptable level.

- Risk of hardware theft / damage
- Data corruption
- Operational errors / Erroneous Input
- Fraud and industrial espionage.
- Viruses
- Hacking

4. Data Protection Legislation

Some countries provide legislation to protect individuals against the misuse of their personal data – examples are Data protection act (UK) or GDPR (General Data Protection Regulation)

This legislation often gives individuals the right to request details of any information held about them by any organisation – a nominal fee may be charged for this – but the request for the data cannot be refused without good legal reason.

Companies who fail to comply with data protection laws can be prosecuted and / or fined huge monetary penalties depending on the seriousness of the breach. Individuals can apply for compensation relating to damages or distress that has been caused – at present this compensation is unlimited in its value.

5. Big Data

Big data is the buzz word which refers to the masses of structured and unstructured information that is collected and stored every moment from mobile phones, websites, social media and various other electronic sources.

- **Four V's (Volume, Velocity, Variety and Veracity)**

  This data is so large that traditional database approaches to storage and analysis are simply not sufficient to cope with the sheer amount of data (**volume**) nor the speed of its arrival (**velocity**). Not to mention the different formats that that data may take **(variety).** In addition to this a fourth dimension of Big Data was added which refers to concerns over its **Veracity**. This recognised that the data may in fact **be inaccurate or lack authenticity** in its unfiltered, raw form.

- **Benefits / Uses of Big Data**

  Competitive Advantage can be gained if businesses are able to analyse and *correctly* interpret this data to gain knowledge and insight on customer preferences, buying habits and useful consumer trends or patterns of behaviour.

- **Risks of Big Data**

  Big data brings with it, unique risks of its own. As discussed above, **safe storage** and **security** of customer data is of particular concern. Businesses who collect this data need to ensure that customers are informed and have **consented** to its use. Similarly, data held or purchased should be kept in **encrypted** form and not be susceptible to data hackers who may attempt to access this confidential information via illegal means.

  The **Independent Commissioner's Office** in UK is the independent authority that deals with **Data protection** breaches and privacy issues. They are closely monitoring the use of Big Data and data analytics to ensure that companies do not fail to uphold key **Data protection principles.**

- **Use / Misinterpretation of Data**

  There is also a concern that data may be **misrepresentative** / **misleading** or actually **misinterpreted by the decision makers** within the business– causing them to take a wrong course of action and potentially waste valuable resources on incorrectly perceived customer information.

6. Evaluation of Information systems.

As with any major investment project, an information system can be evaluated using principles of Net Present Value analysis or a Cost Benefit Analysis.

However, it can be hard to ascertain the 'value' of a new system when benefits are not monetary in nature and are difficult to quantify in this way.

For example A new information system may be hugely **beneficial** to a company in terms of it processing **speed, ease-of-use** and **security of customer data**.

It is difficult to place a financial value on these benefits**.**

In contrast, IT system **costs** are usually easily calculable and include costs such as:

IT equipment /hardware costs, staff training, installation charges, service and maintenance contracts and software licencing costs.

Cost Benefit Analysis and NPV methods are sometime **less useful** due to the **intangible nature of benefits** which can be attributed to a new IT system.

Alternative approaches include using a **Balanced Score card** for this type of evaluation – or for management to attempt to assign a **financial value** based on **the achievement of objectives** that will result from the new system.

ANSWERS TO EXAMPLES

Chapter 1

Answer to Example 1

More accurate calculation of cost per unit (through better allocation of overheads) should lead to **better pricing decisions** being made.

Greater visibility of overhead costs enables management to **understand the causes of these costs** and so use this information **to reduce and control costs** more effectively.

Knowledge of cost driver relationships provides a **more accurate basis for forecasting and budgeting**. Demand for cost- causing activities can be estimated which should lead to more realistic estimates.

Realistic cost per unit information will **support other areas of decision-making** – such as the discontinuation of unprofitable product lines.

Answer to Example 2

(a) Total overheads $190,000

Total labour hours

A	20,000	× 2 =	40,000
B	25,000	× 1 =	25,000
C	2,000	× 1 =	2,000
			67,000 hours

$$\text{O.A.R.} = \frac{190{,}000}{67{,}000} = \$2.836 \text{ per hour}$$

Cost cards:

	A	*B*	*C*
Materials	5	10	10
Labour	10	5	5
Overheads (at $2.84 per hr)	5.68	2.84	2.84
	20.68	17.84	17.84
Selling price	20	20	20
Profit / Loss	$(0.68)	$2.16	$2.16

(b)

	Total	A	B	C
Set-up costs				
(Cost per set up =)	90,000	36,000	46,800	7,200
Receiving				
(Cost per delivery =)	30,000	13,636	13,636	2,728
Despatch				
(Cost per order =)	15,000	5,000	5,000	5.000
Machining				
(Cost per machine hour:)	55,000	23,404	29,256	2,340
	190,00 0	78,040	94,692	17,268
Number of units		20,000	25,000	2,000
Overheads p.u.		$3.90	$3.79	$8.63

Costings:

	A	B	C
Materials	5	10	10
Labour	10	5	5
Overheads	3.90	3.79	8.63
	18.90	18.79	23.63
Selling price	20	20	20
Profit / Loss	$1.10	$1.21	$(3.63)

Answer to Example 3

	X	Y	Z
	$'000	$'000	$'000
Gross margin	897	1,070.00	1,056.00
Less: Customer specific costs			
Sales visits (80/100/140 × $420)	(33.60)	(42.00)	(58.80)
Order processing (200/320/700 × $190)	(38.00)	(60.80)	(133.00)
Despatch costs (200/320/700 × $350)	(70.00)	(112.00)	(245.00)
Billing and collections (200/320/700 × $97)	(19.40)	(31.04)	(67.90)
Profit	736.00	824.16	551.30
Ranking	2	1	3

Answer to Example 4

	Gollum	*Sam*
	$	*$*
Revenue	25,000	21,000
Less: discount	2,500	3,150
Net revenue	22,500	17,850
Less: cost of shoes	(12,500)	(10,500)
customer transport cost	(5,000)	–
customer administration cost	(250)	(500)
Net gain	4,750	6,850
The difference on a unit basis is considerable.		
Number of pair of shoes sold	500	420
Net gain per pair of shoes sold	$9.50	$16.31

Answer to Example 5

This is a common sales tactic for banks –they recognise that students are likely to high earners eventually and so compete to gain their custom early on.

Student customers can be drawn by incentives such as rail cards or concert tickets which represent a cost to the bank and result in an initially unprofitable customer transaction.

Eventually, they hope the majority of students will achieve greater than average salaries and remain loyal to the bank – potentially purchasing mortgages and other financial products in future.

By tying their student customers up with permanent levels of overdrafts – the customer is then retained at least until they can repay that amount. In reality, people often stay with the same current account for their whole working life so represents a profitable application of the customer lifecycle model.

Chapter 2

Answer to Example 1

(1) **Level of inventory holding** - Ideally **inventory holding will be nil f**or Just in time systems. Parts arrive just in time to be included in the production item so that many of the risks of holding inventory (tied up cash, storage space and obsolescence) can be avoided.

(2) **Supplier relationships –** Suppliers become strategic partners – they need to be reliable and able to consistently deliver small quantities exactly when required. The supplies need to arrive quickly and be defect free - there is no allowance in JIT time frame for rejects and reworks.

(3) **Maintenance of machinery** - The tight schedule of JIT production can not allow time to be wasted through faulty machines or mechanical breakdown – therefore a proactive system of **preventative maintenance** will be in place

(4) **Empowerment of workers** – workers are treated with full respect and trust - their ideas are listened to and anyone on the production line has the ability to stop production if required. They are often multi-skilled and can work cross functions

(5) **Pull production flow.** Factory layout is designed to minimise flow time between processes. Because it is a Pull system – the customers orders act like a signal for production to begin.

(6) **Quality** There is a commitment to quality in JIT manufacturing - this links with TQM – there is no time available for reworks or faulty products. The belief is in continuous improvement – a company who is striving to get better.

(7) **Wastefulness** – The JIT philosophy aims to eliminate wastefulness in terms of eliminating all **non-value adding** activities, wasteful/ unnecessary costs and any other inefficient processes.

Other features of JIT include lean production methods, visual control systems, standardisation of parts, high flexibility, fast throughput and short set-up times.

Answer to Example 2

Benefits

- Lower inventory holding costs.
- Reduced risk of obsolescence
- Cash not tied up by inventory
- Greater flexibility
- Responsive to customer demand
- Better supplier relationships
- Improved worker motivation.
- Better quality product.
- Elimination of waste/ inefficiency

Disadvantages

- Risk that supply chain failure will cause consequences in the JIT company.
- Relies on flexible workforce – this may not always be possible.
- Not suitable for businesses that are located in low populated areas or who are geographically wide spread (far from suppliers).
- Difficulty in switching suppliers can mean that best price is not always sought .

Answer to Example 3

JIT purchasing and JIT production go together in the JIT conceptual framework. JIT purchasing facilitates the reduction in inventory levels that is required by JIT production. Synergistic supplier relationships are formed which should result in high quality materials/ components, reliable lead times and supplier flexibility.

JIT production – *lean manufacturing*- a production method that aims to eliminate waste, improve quality, empower workers and eliminate inventory levels to minimum levels possible – ideally zero. The process is based on Pull production and is built upon concepts of continuous improvement, TQM, product design and an overall commitment to the JIT philosophy by the entire organisation.

JIT purchasing – *lean purchasing* – underpinned by good supplier relationships and long term contracts being agreed with small number of 'superior' suppliers – rather than a wide supplier base. JIT purchasing involves frequent, small order sizes and low ordering costs. Delivery lead times are reduced significantly and responsibility for quality is shared with the supplier which reduces the time spent on quality inspection for incoming goods. Suppliers are often treated like strategic partners and involved in decision making process. Successful implementation of JIT purchasing should improve quality, reduce material costs and minimise lead times. This then facilitates the JIT production system.

Answer to Example 4

Differences between BPR and Continuous Improvement.

Point of comparison	***Business Process Reengineering***	***Continuous Improvement***
Philosophy	Scrap and rebuild from 'clean slate'	Gradual continual improvements made to existing processes.
Degree of change	Dramatic, radical	Incremental, small
Timescale	Short period -rapid	Ongoing, long term, open ended
Organisational Impact	High level	Low level
Primary Enabler	Information Technology	Total Quality Management.
Risk of Failure	High risk	Low risk

Answer to Example 5

a)

	A	*B*
Selling price	25	28
Materials	8	20
Throughput p.u.	$17	$8
Machine hrs p.u.	2	1
Throughput Contribution per hour	$8.50	$8

Production Plan

	units	*hours*
A:	20,000 × 2hrs =	40,000
B:	8,000 × 1hr =	8,000
		48,000 hours

Profit

		$
A:	20,000 × $17	340,000
B:	8,000 × $8	64,000
	Total Throughput Contribution	404,000
less	"Fixed" costs (Total Factory Costs)	
	A: 20,000 × $15	
	B: 10,000 × $6	(360,000)
	Profit	44,000

$$\text{Cost per factory hour} = \frac{\$360{,}000}{48{,}000\text{hrs}} = \$7.50$$

b) Throughput accounting ratios:

$$\text{A: } \frac{8.50}{7.50} = 1.13$$

$$\text{B: } \frac{8}{7.50} = 1.07$$

Interpretation: Both products have a TPAR greater than 1 which means they are **both financially viable products** (they return more per hour than the factory cost per hour) However, Product A is more profitable than product B – which is why the production plan we created and prioritised resources to producing all of product A first.

Chapter 3

Answer to Example 1

Selling price = $20 p.u.
Target return = 40% of selling price
Target Cost = **$12 p.u.**

Answer to Example 2

Target return = 30% × 5M = $1.5M p.u.
Expected revenue = 40,000 × $67.50 = **$2.7M**

Answer to Example 3

- The cost of producing the Rollo has been estimated at $9750
- Rollo's shareholders require a mark-up of 25% on all retail car sales.
- Average market price for competitors is $10,000

a) Current cost = $9750

Markup 25% = 9750 x 0.25 = $ 2438 profit per unit (rounded).

Selling price = 9750 + 2438 = **$ 12,188**

This is the selling price calculated using current costs and traditional markup method. If production goes ahead at these levels – the Rolla car will be over priced against the average of $10,000 for equivalent competitor models and will experience poor sales due to low demand levels.

b) Target Cost

Market selling price is $10,000

Markup is 25%

Selling price = Cost x markup

$10000 = Cost x 1.25

$$\frac{10{,}000}{1.25} = \$8000 < \text{Target Cost}$$

Target Gap = $ 9750 - $8000

Gap to close = $1750 per unit.

Target cost of $8000 needs to be our cost per unit for each Rolla. This will cost allow for 25% markup and still meet the market selling price of $10,000.

The Target Gap is the difference in our estimated cost and the target cost. This needs to be closed and costs reduced until they reach $8000 per unit.

c) Methods of Reducing the Gap

Remove non-value adding features – make these optional extras.

This is a common method for reducing a target cost gap. For example – the Rolla may include all sorts of expensive extra features such as heated seats, Bluetooth surround sound, metallic paint etc. These may not be valued by all customers and those who wish to have these extras can pay extra to add them when purchasing the vehicles (which are made Just in Time so features can be added easily based on the order requirements during production).

By removing these extras from the standard model – the cost per unit will hopefully reduce to $8000 or less.

NB) Value engineering – could be used to identify cost-effective features that would be valued by customers.

Other ideas

- **Can labour savings be made** – through using lower skilled workforce on non-essential parts of production (without effecting quality of finished product.)
- **Can the car be made slightly smaller** – this reduces material costs without effecting quality of product or ability to meet its purpose.
- **Can materials be substituted for less expensive materials** – without affecting quality. Eg leather seats become upholstery in standard models.
- **Can productivity of the workforce be improved through enhanced motivation** - performance targets, better organisation etc. This would reduce time per unit.
- **Can efficiency of production be improved –** through reorganisation or better working practices – lean manufacturing and continuous improvement.

NB) Other reasonable suggestions for answers would be accepted

CHAPTER 4

Answer to Example 1

Costs incurred 5 stages in the lifecycle will depend on the product and its market – however, typical costs are listed below.

(***Other answers are acceptable***).

- **Development stage** : Research costs – eg cost of market research. Design costs, Costs of prototyping.
- **Introduction stage** – launch costs, procurement costs, production (materials, labour overheads etc) machinery set up, staff training and selling & distribution costs, advertising costs.
- **Growth** – advertising costs, greater levels of production and machinery maintenance & depreciation, selling & distribution costs, cost of product returns, costs of promotions.
- **Maturity** – production costs, continuing machinery costs, machinery replacement costs selling & distribution costs, cost of product returns & warranty claims, – costs of product development (looking to extend lifecycle and increase market share further) .
- **Decline –** Environmental clean up, decommissioning costs**,** disposal costs – reverse logistic costs (returns and transport costs to recall inventory.)

Answer to Example 2

(a) Estimated total sales = 2,000 + (4 x 12,000) = 50,000 units

Total lifecycle cost = (50,000 x 6) + 60,000 + 30,000 = $390,000

Lifecycle cost per unit = 390,000 / 50,000 = **$7.80**

This is lifecycle cost per unit, - at Selling revenue of 10.50 each **– this product is worthwhile.**

Answer to Example 3

(a) **Customers may not be profitable in the early stages of customer relationship**. The cost of promotions and other expenses necessary to acquire new customers may outweigh the revenue received from them initially.

(b) **Customers, if retained, should eventually increase in their profitability**. They need to be kept at a profitable state as long as possible (ideally kept here indefinitely). At this point, they are **fully engaged with the product/ service** and **repeat sales** and **further purchases** are likely. **Loyalty** levels needs to be promoted. There is a possibility of **new customers** being brought in through existing customer recommendations.

Maintaining this stage could be through increasing **loyalty rewards, targeted offers, service contract-tie ins, unique compatibility of products, further enhancement of features which are valued by customers.**

CHAPTER 5

Answer to Example 1

All centres should have performance measured using controllable factors only.

Cost Centres

Therefore a cost centre could be appraised on total costs per quarter, cost per employee, material costs as a % of total costs and so on.

Profit centres can be appraised on costs and revenues, in addition to profitability measures. This may be profit margin % , Asset turnover, % increase in sales per year.

In addition to the cost related measures discussed above.

Investment centres have autonomy over investment decisions. Therefore their performance can be assessed using **Return on Investment (ROI) and Residual income** (**in addition** to the other measures of **cost, revenue and profitability used to assess profit centres**)

Answer to Example 2

Return from new project = $\frac{17{,}000}{100{,}000}$ 17%

(a) For company:

17% > 15% (target)

Therefore company wants to accept

(b) For division

ROI (without project) $\frac{82{,}000}{500{,}000}$ = 16.4%

ROI (with project) $\frac{82{,}000 + 17{,}000}{500{,}000 + 100{,}000}$ = 16.5%

ROI of division increases therefore divisional manager motivated to accept.

Answer to Example 3

Return from new project = $\frac{16{,}000}{100{,}000}$ = 16%

(a) For company: 16% > 15%
Company wants to accept

(b) For division:

ROI (without project) =16.4%

ROI (with project) $\frac{82{,}000 + 16{,}000}{500{,}000 + 100{,}000}$ = 16.3%

Answer to Example 4

(1) RI (without project)

Profit	82,000
Less: Interest	
15% × 500,000	(75,000)
	US$7,000

RI (with project)

Profit	99,000
Less: Interest	
15% × 600,000	90,000
	US$9,000

$9,000 > $7,000 manager motivated to accept

(2) RI (without project) US$7,000

ROI (with project)

Profit	98,000
Less: Interest 15% × 600,000	90,000
	US$8,000

$8,000 > $7,000 manager motivated to accept

In both cases the decisions are goal congruent

Answer to Example 5

	2014	*2013*
	$m	*$m*
Profit after tax	88	71
Non-cash expenses	15	20
Research and development	11	10
After tax interest (0.7 × 8); (0.7 × 6)	5.6	4.2
Adjusted profit	US$119.6	US$105.2

Adjusted Capital Employed

	2014	*2013*
Capital employed at start of the year	400	350
Non cash expenses	20	
Research and development	10	
Non-capital leases	16	16
	US$446	$366

Weighted average Cost of Capital:

2013: (15% × 0.7) + (9% × 0.7 × 0.3) = 12.39%
2014: (17% × 0.7) + (10% × 0.7 × 0.3) = 14.00%

EVA 2013 = 105.2 – (366 × 0.1239) = $59.85m

EVA 2014 = 119.6 – (446 × 0.14) = $57.16m

CHAPTER 6

Answer to Example 1

(a) Selling price			20
Costs:	A	10	
	B	4	14
Profit			$6

(b)

	A		*B*
Total Profit	12	Selling price	20
Cost	10	Total Profit	12
Profit	$2	Costs	4 16
		Profit	$4

Answer to Example 2

(a) Transfer price = 15 × 1.2 = $18 p.u.

(b) Selling price			30
Costs:	A	15	
	B	5	20
Profit			$10

(c)

	A		*B*
Total Profit	18	Selling price	30
Cost	15	Total Profit	18
Profit	$3	Costs	5 23
		Profit	$7

Answer to Example 3

(a) Transfer price = 20 × 1.2 = $24 p.u.

(b) Selling price			30
Costs:	A	20	
	B	8	28
Profit			$2

(c)

	A		*B*
Total Profit	24	Selling price	30
Cost	20	Total Profit	24
Profit	$4	Costs	8 32
		Profit	$(2)

Answer to Example 4

For A: T.P. > 20

For B: T.P. < 30 - 8

< 22

Sensible T.P. between $20 and $22 p.u.

Answer to Example 5

For A: T.P. > 15

For B: T.P. < 35 - 10

< 25

Sensible range between $15 and $25 p.u.

Answer to Example 6

For A: T.P. > 20

For B: T.P. < 25 (as in previous example)

Sensible range between $20 and $25 p.u.

Answer to Example 7

(a) For A: T.P. > 8

For B: T.P. < 14

Sensible range between $8 and $14 p.u.

(b) For A: T.P. > 8

For B: T.P. < 20 – 4

< 16

Sensible range between $8 and $16 p.u.

Answer to Example 8

	X	*Y*
Contribution	$20	$30
Hours	5	10
Contribution per hour	$4	$3

Therefore, if no transfers to B then A would sell exactly and generate $4 per hour contribution.

To make transfers of Y worthwhile, A need to charge at least 70 + (10 × 4) = $110 p.u.

CHAPTER 7

Answer to Example 1

		20X7	*20X6*
Net profit margin	$\left(\frac{790}{7,180}\right)$	11%	8.5%
Gross profit margin	$\left(\frac{1,795}{7,180}\right)$	25%	22.5%
Return on capital	$\left(\frac{790}{2,690}\right)$	29.4%	25.7%
Asset turnover	$\left(\frac{7,180}{2,690}\right)$	2.67	3.02
Current ratio	$\left(\frac{2,314}{965}\right)$	2.4	2.4
Quick ratio (or acid test)	$\left(\frac{1,308}{965}\right)$	1.36	1.15
Inventory turnover	$\left(\frac{1,006}{5,385}\times 365\right)$	68.2 days	75.5 days
Receivables days	$\left(\frac{948}{7,180}\times 365\right)$	48.2 days	47.5 days
Payables days	$\left(\frac{653}{5,385}\times 365\right)$	44.3 days	44.7 days
Gearing ratio	$\left(\frac{500}{2,190}\right)$	22.8%	28.6%
Interest Cover		15.8times	8.88times

Answer to Example 2

Dupont Relationship based on figures above

Net profit margin x Asset turnover = ROCE

11% x 2.67 = 29.37% < This gives same ROCE % as calculated separately above.

CHAPTER 8

Answer to Example 1

Non-financial performance indicators – supermarket chain
Suggestions below – many possible answers.

Environmental
Kg of waste disposed of per week
Number of tonnes of plastic carrier bags recycled per quarter.

Customer service
Average number of people queuing before additional sales till is opened.
% of customers voting the level of service as 'good' or 'excellent' (using questionnaire)

Employee satisfaction
Staff turnover (compared to previous years or target figures)
Staff surveys - % of staff who believe they are treated fairly
Number of staff attending employee participation days (versus target or previous figures).

CHAPTER 9

No examples

CHAPTER 10

Answer to Example 1

Capital investment decisions (sometimes called **Capital Budgeting)** relate to the funds spent by the business to further their **long term objectives**. It usually refers to an acquisition, improvement or replacement of a non-current assets such as new machinery or maybe acquisition of another business.

Features which may increase the riskiness of these decisions are –

Capital investment projects usually represent a **long term commitment**- with a **large initial outlay** required. **Benefits of the project come in future years**.

The decisions to go ahead with such large projects are often – to some extent – **irreversible.**

Investments often need different **sources of finance** so may involve **changing the capital structure** of the business – increasing the gearing level or issuing equity.

Many figures in investment appraisal analysis are **estimates** and some may be many years ahead, which increases risk and uncertainty.

As a result capital investment projects usually need highest level of senior management to authorise.

Answer to Example 2

ARR = $25, 000 x 100

= $45,000

ARR = 55.56%

Workings

$$\text{Average Profits} = \frac{(20{,}000+30{,}000+40{,}000+10{,}000)}{4 \text{ years}} = \textbf{\$25,000}$$

$$\text{Average Investment} = \frac{\$80{,}000+\$10{,}000}{2} = \textbf{\$45,000}$$

Answer to Example 3

	000's	*cumulative cashflow 000's*
Year 0(Now)	($1200)	(1200)
Year 1	$300	(900)
Year 2	$500	(400)
Year 3	$800	400
Year 4	$850	

Project will payback in 2.5 years (or 2 years 6 months)

CHAPTER 11

Answer to Example 1

		df @ 10%	*P.V.*
0	(80,000)	1	(80,000)
1	20,000	0.909	18,180
2	30,000	0.826	24,780
3	40,000	0.751	30,040
4	20,000	0.683	13,660
		N.P.V+	6,660

+ POSITIVE result – therefore Accept project

Answer to Example 2

Further considerations

Financial considerations are the forecasts reasonable and estimated using reliable methods. Is the cost of capital for the company accurate.

What are the **risks of the project.** Do we have enough spare capital to fund the initial outlay required. Can we afford to tie up our funds long term.

Commercial factors – is this project in line with our corporate objectives – does it fit our strategy- will it add value for customer – will the investment be compatible with our current operations – eg do staff need training, will systems be compatible with the new machinery etc.

Any qualitative factors- eg is the investment ethically / environmentally sound, will it impact employee morale, will the **quality** of our output or service offered be improved or reduced.

* NB) Any reasonable examples of **other factors** will be acceptable

Answer to Example 3

(a)

		df @ 15%	*P.V.*
0	(80,000)	1	(80,000)
1	20,000	0.870	17,400
2	30,000	0.756	22,680
3	40,000	0.658	26,320
4	20,000	0.572	11,440
		N.P.V	(2,160)

Negative results therefore –REJECT project

(b)

$$IRR \approx L + \frac{NPV_L}{NPV_L - NPV_H} - (H-L)$$

$$IRR = 10 + \frac{6660}{6660 - (2160)} - (15-10)$$

$$IRR = 13.78$$

(c) Part b tells us that the IRR of the project is approximately 13.78%.

Discounting the project cash flows at this rate will result in an NPV figure that is (approximately) equal to zero. *(You can try this if you have time!)*

The IRR tells us many things – we can find the sensitivity of our cost of capital % estimate – i.e we know that if our cost of capital turns out to be higher than 13.78% then this project will no longer be financially viable.

It informs us that the 'return' on this project is equivalent of receiving a 13.78% return on investment.

It also tells us at what discount rate the project breaks even

Answer to Example 4

		df @ 15%	*P.V.*
0	(45,000)	1	(45,000)
1–8	8,000	4.487	35,896
		N.P.V	(9,104)

Negative – Reject

Answer to Example 5

		df @ 12%
	1 – 13	6.424
Less:	1 – 3	2.402
	4 – 13	4.022

4 – 13 20,000 × 4.022 = **80,440**

Answer to Example 6

			P.V.
0	(100,000)	1	(100,000)
	12,000	1	
1– ∞		10	120,000
		PV	20,000

Example 7

		df @5%
	1– ∞	20.000
less:	1– 4	3.546
		16.454

5 – ∞ 18,000 × 16.454 = 296,172

CHAPTER 12

Exercise 1

Materials		(5,000)
Labour		
	($150,000 –$60,000)	90,000
Research	– wages	60,000
	– severance ($35,000 – $15,000)	20,000
Equipment	($8,000 – $6,000)	2,000
Lost rental		7,000
		$174,000
Sales price		$300,000

Project should be allowed to proceed.

Answer to Example 2

	0	*1*	*2*	*3*	*4*
Machine	(100,000)				
Working capital	(20,000)				20,000
Scrap					20,000
Operating flows		30,000	30,000	40,000	40,000
Net cash flow	(120,000)	30,000	30,000	40,000	80,000

Answer to Example 3

Capital allowance calculations:

			Tax savings
y/e 31.12.03:	Cost	10,000	
	CA (25%)	2,500× 30%	750
		7,500	
y/e 31.12.04:	Sale	6,000	
	CA	1,500× 30%	450

Cash flows:

	0	*1*	*2*	*3*
Operating flows		5,000	7,000	
Tax on op. flows			(1,500)	(2,100)
Cost	(10,000)			
Sale			6,000	
Tax savings on Cap. Allowances			750	450
Working Capital	(1,000)		1,000	
Net cash flow	(11,000)	5,000	13,250	(1,650)
d.f @ 10%	1	0.909	0.826	0.751
P.V.	(11,000)	4,545	10,944	(1,239)
			NPV = +3,251	Accept

Alternative layout of cash flows:

	0	*1*	*2*	*3*
Operating flows		5,000	7,000	
Cap. Allowances		(2,500)	(1,500)	
Taxable profit		2,500	5,500	
Tax on profit			(750)	(1,650)
Add: Capital Allowances		2,500	1,500	
Cost	(10,000)			
Sale			6,000	
Working Capital	(1,000)		1,000	
Net cash flow	(11,000)	5,000	13,250	(1,650)

Answer to Example 4

Capital allowances calculations:

			Tax savings
Year 1	Cost	2,800,000	
	CA (25%)	700,000 × 25%	175,000
		2,100,000	
Year 2	CA (25%)	525,000 × 25%	131,250
		1,575,000	
Year 3	Sale	1,000,000	
	CA	575,000 × 25%	143,750

Cash flows:

	0	1	2	3	4
Operating flows					
Revenue		2,000	2,140	2,290	
Materials		(864)	(933)	(1,008)	
Labour		(735)	(772)	(810)	
		401	435	472	
Tax on op. flows			(100)	(109)	(118)
Cost	(2,800)				
Sale				1,000	
Tax saving on CA's			175	131	144
Working Capital	(200)			200	
Net cash flow	(3,000)	401	510	1,694	26
d.f @ 10%	1	0.909	0.826	0.751	0.683
P.V.	(3,000)	365	421	1,272	18
			NPV =	(924)	REJECT

Answer to Example 5

(a)

	Current prices			Cash flows		d.f. @ 15%		P.V.
0	(120,000)			(120,000)		1	=	(120,000)
1	60,000 ×	1.05	=	63,000	×	0.870	=	54,810
2	60,000 ×	$(1.05)^2$	=	66,150	×	0.756	=	50,009
3	60,000 ×	$(1.05)^3$	=	69,457	×	0.658	=	45,703
						NPV		+30,522

(b)

$$1 + r = \frac{1+m}{1+i}$$

$$= \frac{1.15}{1.05} = 1.0952$$

r = 9.52% (use 10% in the tables)

	Current prices	d.f. @ 10%		P.V.
0	(120,000)	1	=	(120,000)
1 – 3	60,000	2.487	=	149,200
		NPV		+29,220

(Note: the difference is due to using an effective rate of 10% instead of 9.52%)

(c) In theory, higher inflation would lead to higher cost of capital. The real (or effective) rate would stay unchanged.

CHAPTER 13

Answer to Example 1

(a) With no capital rationing invest in all projects giving a positive N.P.V. In this example invest in all 4 projects.

(b)

	A	*B*	*C*	*D*
N.P.V	50	57	36	50
Time 0 investment	500	600	300	400
N.P.V per $	$0.10	$0.095	$0.12	$0.125
Ranking				

Investment	*Capital*	*N.P.V.*
100% of D	400	50
100% of C	300	36
100% of A	500	50
⅔ of B	400	38
	1,600	174

(c) Either

		N.P.V.
	A + B + C	143
or	A + B + D	157
or	B + C + D	143

Highest NPV is A + B + D

Answer to Example 2

1 year replacement cycle:		*d.f. @ 15%*	*P.V.*
0	(72,000)	1	(72,000)
1	(7,200)	0.870	(6,264)
1	24,000	0.870	20,880
		NPV	(57,384)

$$\text{Equivalent Annual cost} = \frac{57{,}384}{\text{1 year annuity df}} = \frac{57{,}384}{0.870} = \$65{,}959 \text{ p.a.}$$

2 year replacement cycle:		*d.f. @ 15%*	*P.V.*
0	(72,000)	1	(72,000)
1	(7,200)	0.870	(6,264)
2	(9,600)	0.756	(7,258)
2	16,600	0.756	12,550
		NPV	72,972)

$$\text{E. A. C.} = \frac{72{,}972}{1.626} = \$44{,}878 \text{ p.a.}$$

3 year replacement cycle:		*d.f. @ 15%*	*P.V.*
0	(72,000)	1	(72,000)
1	(7,200)	0.870	(6,264)
2	(9,600)	0.756	(7,258)
3	(12,000)	0.658	(7,896)
3	9,600	0.658	6,317
		NPV	(87,101)

$$\text{E. A. C.} = \frac{87{,}101}{2.283} = \$38{,}152 \text{ p.a.}$$

The machine should be replaced every 3 years.

CHAPTER 14

Answer to Example 1

Factors influencing selling price:

Cost of producing

Competitors pricing / strategies

Market share desired

The type of product – eg luxury good, or new innovative software

Strength of the brand.

Target customers level of disposable income.

Elasticity of demand**(**

+ any other reasonable suggestion

Answer to Example 2

(a)	Materials	10
	Labour	8
	Variable o/h	5
	Fixed o/h (50,000 ÷ 10,000)	5
	Full cost	28
	Profit	5.60
	Selling price	$33.60

(b)	Materials	10
	Labour	8
	Variable o/h	5
	Marginal cost	23
	Profit	9.20
	Selling price	$32.20

Answer to Example 3

a is $12 + $\frac{16,000}{2500}$ x $1 = $18.40

b = change in price / change in qty = 0.0004

P = 18.40 -0.0004Q

Answer to Example 4

S.P. p.u.	*Demand*	*Cost p.u.*	*Total Revenue*	*Total cost*	*Total profit*	*Marginal Revenue*	*Marginal cost*
16	100	14.0	1,600	1,400	200	1,600	1,400
15.5	200	13.9	3,100	2,780	320	1,500	1,380
15	300	13.8	4,500	4,140	360	1,400	1,360
14.5	400	13.7	5,800	5,480	320	1,300	1,340
14	500	13.6	7,000	6,800	200	1,200	1,320
13.5	600	13.5	8,100	8,100	-	1,100	1,300
13	700	13.4	9,100	9,380	(280)	1,000	1,280

Optimum selling price is $15 per unit

Answer to Example 5

P = 300-0.004Q
MC = MR
40 = 300-0.008Q
Q = 32500

P = 300- 0.004(32,500)
P = $170

Answer to Example 6

(a) $PED = \frac{\frac{200-100}{100}}{\frac{15.5-16}{16}} = \mathbf{32}$

(b) $PED = \frac{\frac{400-300}{300}}{\frac{14.5-15}{15}} = \mathbf{10}$

CHAPTER 15

Answer to Example 1

(a)

		d.f. @ 15%	*P.V.*
0 cost	(150,000)	1	(150,000)
1 – 15 Contribution	41,250 p.a.	5.847	241,189
1 –15 Fixed costs	(15,000) p.a.	5.847	(87,705)
15 scrap	15,000	0.123	1,845
		NPV	+5,329

ACCEPT PROJECT

(b) (i) sensitivity of initial investment = $\frac{5,329}{150,000} \times 100\% = +3.55\%$

(ii) sensitivity of sales volume = $\frac{5,329}{241,189} \times 100\% = -2.21\%$

(iii) sensitivity of contribution p.u. = $\frac{5,329}{241,189} \times 100\% = -2.21\%$

(iv) sensitivity of fixed costs = $\frac{5,329}{87,705} \times 100\% = +6.08\%$

(v) sensitivity of scrap value = $\frac{5,329}{1,845} \times 100\% = -289\%$

(vi)

		d.f. @ 20%	*P.V.*
0	(150,000)	1	(150,000)
1 – 15	41,250	4.675	192,844
1 – 15	(15,000)	4.675	(70,125)
15	15,000	0.065	975
		NPV	(26,306)

$$\text{IRR} = 15\% + \frac{5,329}{5,329 + 26,306} \times 5\% = 15.84\%$$

$$\text{Sensitivity of cost of capital} = \frac{0.84}{15} \times 100\% = +5.6\%$$

(c) No answer

Answer to Example 2

(a) Expected demand = (50,000 ×0.5) + (60,000 × 0.4) + (40,000 ×0.1) = 53,000 units

Expected contribution = 53,000 × 50% ×$10 = $265,000 p.a.

		d.f. @ 20%	*P.V.*
0	(200,000)	1	(200,000)
1 – 4	265,000 p.a.	2.589	686,085
1 – 4	(140,000) p.a.	2.589	(362,460)
4	50,000	0.482	24,100
		Expected NPV	$147,725

(b) Expected fixed overheads = (100,000 × 0.20) + (140,000 × 0.35) + (180,000 × 0.25) + (220,000 × 0.20) = 158,000 p.a.

		d.f. @ 20%	*P.V.*
0	(200,000)	1	(200,000)
1 – 4	250,000	2.589	647,250
1 – 4	(158,000)	2.589	(409,062)
4	50,000	0.482	24,100
		Expected NPV	$62,288

Answer to Example 3

x	*p*	*px*	*x – x̄*	*p (x – x̄)²*
10	0.2	2	– 5.5%	6.05
15	0.5	7.5	– 0.5%	0.125
20	0.3	6	+ 4.5%	6.075
		15.5%		12.25
		x̄		

Standard deviation = $\sqrt{12.25}$ = 35%

The expected value of return = 15.5%

The standard deviation is 3.5% (expressed in same units as the data given).

The coefficient of variation is 3.5/15.5 = 0.2258 which is 22.6% (This % gives an indication of relative magnitude of variation in the data).

CHAPTER 16

Answer to Example 1

The expected value will be (0.3*50,000) + (0.7 * -20,000) = $1000.

In the long run they should end up with an average profit of $1000.

On the basis of EV alone - the decision maker can **accept** the project.

However, the actual result of the venture may be loss making. The principle of expected values is **designed for experiments that are due to be repeated multiple times** – therefore using this technique to appraise a one-off venture may not be appropriate.

Exercise 2

(a)

Contract size \ *Demand*	400u	500u	700u	900u
300u	2,900	3,400	4,400	5,400
500u	3,500	4,000	5,000	5,000
700u	4,100	4,600	4,600	4,600
800u	4,400	4,400	4,400	4,400

(b) (i) Expected value if contract size =

300 units = (0.2×2,900) + (0.3 × 3,400) + (0.4 × 4,400) + (0.1 × 5,400) = **$3,900**

500 units = (0.2 × 3,500) + (0.3 × 4,000) + (0.5 × 5,000) = **$4,400**

700 units = (0.2 × 4,100) + (0.8 × 4,600) = **$4,500**

900 units = **$4,400**

Sign contract for **700 units**

(ii) **maximin**

Worst outcome from:

300 units = **$2,900**

500 units = **$3,500**

700 units = **$4,100**

800 units = **$4,400**

Sign contract for **800 units**

(iii) **Maximax:**

Best outcome from

300 units = **$5,400**

500 units = **$5,000**

700 units = **$4,600**

800 units = **$4,400**

Sign contract for **300 units**

(iv) Regret table:

Contract size \ Demand	400u	500u	700u	900u
300u	1,500	1,200	600	0
500u	900	600	0	400
700u	300	0	400	800
800u	0	200	600	1,000

Worst regret for

300 units = **$1,500**

500 units = **$900**

700 units = **$800**

800 units = **$1,000**

Sign contract for **700 units**

(c) With perfect knowledge of the level of demand, the payoffs would be as follows:

Result of perf. know.	Decision Contract	Payoff $
400	800u	4,400
500	700u	4,600
700	500u	5,000
900	300u	5,400

The expected return with perfect knowledge =

(0.2 × 4,400) + (0.3 × 4,600) + (0.4 × 5,000) + (0.1 × 5,400) = $4,800

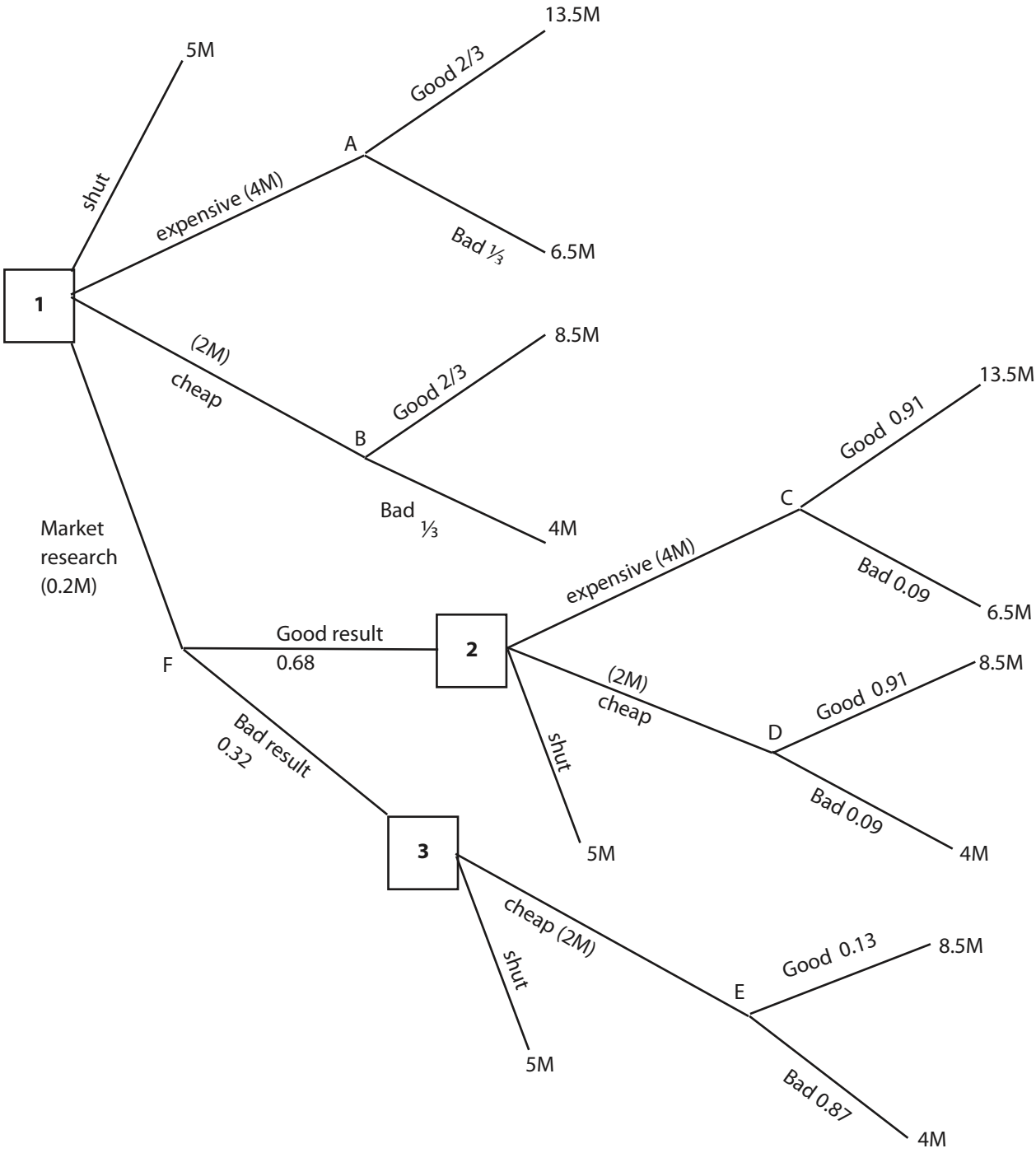
The expected return without perfect knowledge (from (b)(i) is $4,500

So the most to pay for perfect knowledge

= 4,800 – 4,500

= $300

Answer to Example 3



Decisions

at 2: choose expensive, 8.87M (12.87 – 4)

at 3: choose shut, 5M

Expected value at F, (0.68 × 8.87M) + (0.32 × 5M) = 7.63M

Decision at 1: choose market research, 7.43M (7.63 – 0.2)

Answer to Example 4

(a) Current Assumptions – based on 1000 units sold:

	$
Sales Revenue	30,000
Variable costs	(10,000)
Contribution	20,000
Fixed Costs	(15,000)
Profit	5,000 <Based on these estimates – this project will be profitable

b) Sensitivity Analysis

Sales revenue

$$\frac{5,000}{30,000} \times 100 = 16.6\%$$

Sales Volume (this is like sensitivity of contribution)

$$\frac{5,000}{20,000} \times 100 = 25\%$$

Total Variable costs

$$\frac{5,000}{10,000} \times 100 = 50\%$$

Fixed costs

$$\frac{5,000}{15,000} \times 100 = 33.3\%$$

c) Interpretation.

Each element can be interpreted in similar way as below:

If total sales revenue was to fall by more than 16.6% (of its current estimated value) then the project will be loss making.

If the total variable costs were to rise by more than 50% of the current estimated figure then the project will become loss making.

Critical variable: Sales Revenue

In sensitivity analysis – the smallest % of the results identifies the most critical variable.

In this case - sales revenue (based on the estimated selling price) is the lowest percentage of the project. This means management should recognise that this variable needs to be carefully estimated and based on thorough market research. The analysis tells them that a drop in selling price of more than 16.6% will make the project non-viable.

All sensitivity calculations assume the other variables of the project are held constant.

CHAPTER 17

Answer to Example 1

Risks associated with a foreign venture could be:

- Product is not a success on foreign market,
- Exchange rate moves unfavorably when large payment or receipt is due in foreign currency.
- Foreign government seizes assets and takes control of the business.
- Foreign taxation rate increases and increases tax expenses.
- Staff may not learn the language sufficiently to be able to operate business abroad.

If any of the risks are seen as high impact and highly probable – then the foreign venture may be **avoided** completely and the operations remain based in home country only. This would be an appropriate response if there seemed a high chance of political instability and possibility of loss of control of foreign entity.

Risks that can be reduced such as adverse exchange rate movements in the period when a foreign receipt is due to be paid in home currency –can be managed through hedging techniques such as Forward Contracts.

Risks that may be transferred – such as the risk that the product doesn't sell on the foreign market could be shared via a joint venture with an existing foreign entity.

Risks that may be accepted could relate to small short-term issues that are not deemed to be of individual significance.

CHAPTER 18

No Exercises