Content

Introduction

There are different study materials and modes for you to prepare for ACCA professional exams.

You can prepare the exam through self-study mode by reading textbooks and practicing revision tests from Approved Content Providers

Or you can go directly to the classes offered by ACCA Approved Learning Partners and stick into their notes.

However, no matter you are choosing which modes of study or which textbook, you need to know the technical articles published by ACCA for each paper is one of the best materials to prepare for your exams that you cannot miss.

In general, the articles are published by ACCA exam team and the contents are updated on a regular basis.

They highlight the core concepts or important areas that a lot of students cannot do well in the past exams.

The most important part is technical articles are generally the guidance to which question to be seen in upcoming exam.

Here are June 2018 examiners comments on ACCA Paper P7 (Advanced Audit & Assurance):

Question Five

This was a reporting question and was in two sections. It was noted that this question was favoured by candidates who had obviously read the recently updated relevant article on the student website.

The second requirement was to critically appraise an extract from an auditor's report, which had been incorrectly prepared and needed amendment. As noted above it was clear that the candidates who selected this question had evidently read the relevant article and were able to identify that the sections were in the wrong order, contained inappropriate wording and that the key audit matters and emphasis of matters paragraphs had been incorrectly used. Good candidates were able to explain when an issue should be included as a key audit matter or if the issue would result in a qualification and hence needed to be part of the basis of opinion paragraph. Other candidates correctly commented that it would be inappropriate to include an emphasis of matter paragraph but that the report should include a section headed material uncertainty related to going concern.

Since it help thousands of students to prepare exam, I organized the articles published by ACCA and summarized them according to their topics and syllabus with relevant questions as Supplementary Notes for those who are interested to focus on the key or challenging areas.

Remember these articles are helping you to enhance your knowledge on particular subjects, and not a substitute of approved textbook.

Chapter 1 Management Information Systems

Executive Summary

Information systems (IS) is a topic you need to be ready for in all sections of the Performance Management exam. The examiner reports state that students regularly overlook this area of the syllabus, so make sure you cover it during your studies.

Information systems (IS) are critical for Performance Management: IS greatly aids in defining, measuring and monitoring performance metrics and comparing them against targets and benchmarks. It is a topic you need to be ready for in all sections of your exam. The examiner reports state that students regularly overlook this area of the syllabus, so make sure you cover it during your studies.

Role of IS

Information Systems are the backbone of a modern company. IS enables communication, sales and marketing, supply chain management, decision-making, employee management, process improvement and much more. Once considered a tool to improve efficiency, IS is now considered an important source of competitive advantage.

Think of a successful company you've recently read about or interacted with, and chances are you can also think of an example of how that company uses IS to distinguish itself from the competition. You can probably think of ways IS has changed the way you prepare for your ACCA exams—you might watch videos, take online courses, and participate in online forums. Moreover, you might have learned of these solutions through targeted advertising in your social media.

First, make sure you are familiar with some of the basic terminology of Information Systems for your PM exam:

Internet vs intranet
The term 'internet' describes the global network of computers and devices that are all connected with an Internet Protocol ('IP') address. I'm sure you are familiar with this and use it regularly to browse content the web (for example, reading this article), access social media, and use many of the apps in your smartphone.

'Intranet' refers to a subset of the internet that is blocked off from the public and only available to a certain organisation. For example, a university might have a 'private' web portal where students can log in with a username and password and then see their schedules, access student message boards, or upload their assignments.

Networks
A 'network' is a group of computer systems that communicate by physical and/or wireless connections. The wifi router you might have in your home is connected to the internet with a physical cable, and it then allows computers in your home to connect through the wireless network that it broadcasts.

Wireless technology
Wireless technology is a fast-growing area of technology; as its name implies, it refers to communication without cables. Moreover, you are probably interacting with wireless technology regularly. You might connect headphones or other devices to your smartphone with Bluetooth, the car you drive might use Radio Frequency ID (RFID) tags embedded on individual components to monitor maintenance and repair history, and the shipping

company that delivers parcels to your home is probably using a variety of these technologies to track packages and monitor performance.

Categories of IS

Ensure that you understand and can distinguish between different types of information systems. While the latest developments in cloud computing, performance dashboards, and big data bring in new terminology and concepts, the following classic IS ideas form a starting place and are required knowledge for your Performance Management exam.

Transaction processing systems (TPS)
These are systems used by operational staff to capture data and make processes more efficient, improving the accuracy and timeliness of information. Data will primarily be high-frequency and short term.

At your local supermarket, you end your shopping trips at the cashier when your groceries are probably scanned, and your total bill is then automatically calculated. This is a classic example of a TPS. The data collected helps the supermarket produce an accurate sales receipt and is also used to track inventory and understand shopping patterns.

Large retailers are now using 'geo-analytic' software which tracks your movements through a large store by monitoring your smartphone's wifi signal from various routers. This is another example of a TPS.

Starbucks is beginning to use high-tech coffee machines in their stores that communicate information via the cloud on machine usage, maintenance, and even customer preferences—1examples of the transaction process, big data, and wireless technology.

Management information systems (MIS)
These are systems used for structured decision-making that help managers analyse performance and control the business. They draw mainly on summarised, internal information from a company's existing operations. For example, an MIS might help the manager of a supermarket to monitor inventory levels and determine reordering requirements, understand product profitability, and coordinate staff.

A modern MIS can access a variety of data types using big data and then present this information in real-time, with visualisations. An e-commerce company might build an MIS for a sales manager that monitors KPIs such as, 'Site visit to purchase ratio,' 'regional sales status,' or 'sales by channel.'

Executive information system (EIS)
These are systems that help senior managers analyse organisational performance, see trends, and make decisions with a highly summarised picture of the business. An EIS not only uses internal information but also brings in external information, like information related to the markets in which the company operates. A modern EIS is sometimes referred to as a

'dashboard,' where critical KPIs are presented with charts, tables, and other graphical tools, helping the manager to visualise performance.

Continuing with our supermarket example, a senior manager might use a performance management dashboard that compares sales or profitability of different regions using a chart showing performance over time. It might show news headlines about the company from external sources, share price, and a real-time summary of customer feedback.

Enterprise resource planning systems (ERPS)
This term describes a system where many diverse business functions of an enterprise, such as HR, sales, and supply chain, are integrated under one database system. SAP is an example of such software.

Consider an airline: 20 years ago, the company might have had separate IT systems for passenger bookings, accounting, and HR. Now, SAP offers a specific ERP product for the airline industry that integrates business processes such as fuel management, route performance management, catering, airplane maintenance, real-time customer feedback, and direct flight booking all under one unified system. It allows information to flow between all business functions and facilitates connections with external stakeholders, such as suppliers and customers. Such a tool greatly enhances control, data analytics and performance management, as KPIs from many business functions can be monitored on one dashboard.

An ERP will also enable modern accounting practices, such as activity-based costing, as it will be easier to identify cost pools and cost drivers.

Customer relationship management software (CRMS)
CRM software (which can also be contained as a module in an ERPS) is software that helps companies by centralising customer communications, purchasing history, sales leads and more into one database. This helps a company's sales team become more productive, improve communication, automation of processes, and measure sales performance.

A retail company might use a CRMS and customer loyalty card information to automatically email customers about specific offers that they may be interested in, or drive a targeted social media advertising campaign.

If you've ever purchased anything using Amazon.com or other modern e-commerce companies, you have probably seen sections on the website, 'recommended for you,' or 'other people have also purchased…' These features are driven by CRM functionality.

New trends
The output of a Management Information System that can be viewed on a computer, tablet, or smartphone is often referred to nowadays as a 'dashboard.' This idea is similar to the purpose of dashboard in an airplane or a car which answers questions such as, 'How fast are we going?' 'How much fuel do we have?' 'Is the engine running at the right

temperature?' An effective performance management dashboard answers critical questions like for a business manager.

New tools are readily available, such as Microsoft Business Intelligence, that allows for the creation of highly customised dashboards for decision-makers at all levels of a company, drawing on many types of data (internal, external, financial, non-financial), to create customised performance metrics for any organisation.

Sources of information

A company has many sources of information to draw upon, which can be traditionally be categorised as internal vs. external. Internal information is easier to source, while external information can be more challenging to acquire. External information is particularly useful for strategic planning, when a company needs to consider market share, industry trends, and customer behaviors.

Internal sources can include, for example, the company's accounting and production records, human resource records, website traffic, and call centre data. Information gained from these sources can enable a company to understand product profitability, production efficiency, and employee utilisation. A retailer analysing customer shopping behaviour with information from their CRMS would be using internal information.

External sources of information come from the environment in which a company operates and can include competitor's websites, social media, credit rating agencies, and internet news, for example. A company that analyses feedback from social media sites and uses the internet research to identify new customer segments would be using external information.

Cost vs benefit

Companies should ensure that the benefit received from management information exceeds the costs of gaining that information. For example, the implementation of an ERP system can bring many benefits, such as improved business intelligence, streamlined procedures, improved productivity, and lower cost per accounting transaction.

However, such a system also comes with costs. New software, hardware, testing, and other implementation costs will be incurred by the company, as well as potential disruption to people's work routines, and the need to overcome resistance to change.

Controls over information systems

Ensure that you have a working knowledge of the following controls over information systems for your Performance Management exam:

Physical controls

These are controls that prevent unauthorised people from gaining physical access to

computer systems. Locked doors, picture IDs, and security cameras are examples of physical controls.

Logical controls
Once someone has gained physical access to a computer system, the next level of security would be logical controls. Passwords and access rights are examples of logical controls.

Administrative controls
Administrative controls are those that are designed to influence peoples' behavior toward IS systems and practices. IT training and certifications, implementation of new procedures and discipline policies are examples of administrative controls.

Anti-virus
Most computer users will be familiar with viruses: software intentionally created to harm your computer or data. While this is a complex topics which evolves quickly, the idea of anti-virus software is straight-forward: software designed to prevent, detect, and remove viruses. You most likely run both anti-virus and firewall (see below) software on your personal computer.

Firewall
This term was first used to describe a physical wall in a building that keeps a fire contained; in IS, it describes a type of control that prevents access to a computer or computer network. Your company probably uses a firewall to keep hackers out of their computer networks, and if you are using a Windows operating system there is firewall functional included.

Validation
Validation is a broad type of control used to ensure the accuracy, rather than security, or data. When you enter your birthday on a web form, you are usually asked to pick the date, month and year from pulldown menus or by clicking on a calendar tool. Moreover, you are probably not allowed to proceed to the next step of what you are doing if you left the birthday field blank. These are two examples of validation—the first control forces you to enter a valid date, and the second ensures you don't leave the field blank.

Encryption
This is a control whereby your data is encoded in a way that makes it extremely difficult for people to decode and then use your data if they were to gain access to it. Flash drives often come with encryption software included—this doesn't prevent loss of the flash drive, but if it falls into the wrong hands it prevents unauthorise access.

Dial-back security
This is an older type of control that comes from the era of dial-up networking when computer users often used a physical phone line to dial-in access the internet. This system works by calling the user back on a pre-determined phone line to ensure that access is being granted from an authorised location.

Confidentiality agreements
This is an example of an administrative control that spells out the responsibilities, duties, and potential penalties of employees in terms of ensuring that they keep data private, secure and safe away. Confidentiality agreements are commonly used in many larger companies.

Conclusion

Information systems are becoming an ever-increasingly important aspect of performance management—gaining knowledge in the area will add to your employability if you are not yet working, and help you advance faster in your career if already are. ACCA recognises this importance which is why it's an important part of your PM syllabus—make sure you study this often-overlooked area and be ready for it on your upcoming PM exam.

Written by Steve Willis, finance and accountancy trainer

Chapter 2 Big Data

Executive Summary

Big data is part of the Performance Management syllabus. But what exactly is big data?

Big data is part of the Performance Management syllabus.

What is big data?

There are many definitions of the term ‘big data’ but most suggest something like the following:

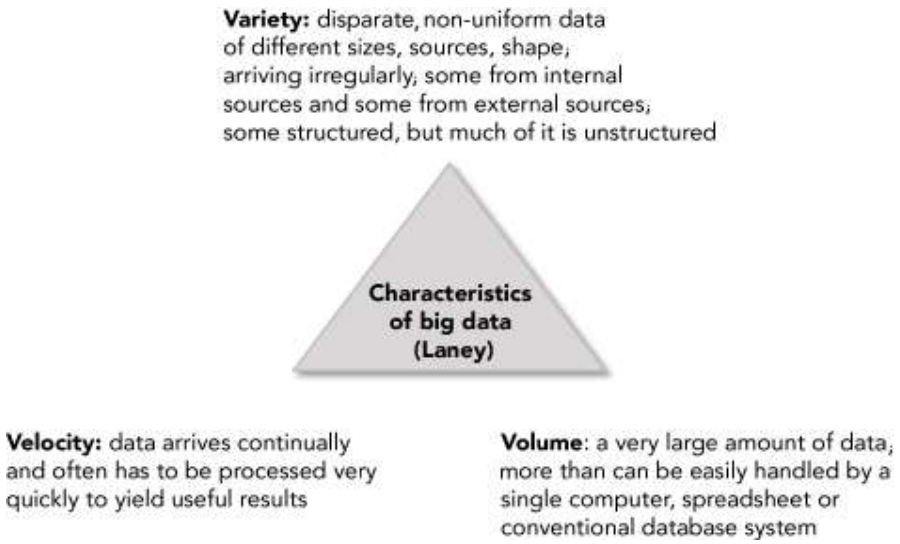
'Extremely large collections of data (data sets) that may be analysed to reveal patterns, trends, and associations, especially relating to human behaviour and interactions.'

In addition, many definitions also state that the data sets are so large that conventional methods of storing and processing the data will not work.

The characteristics of big data, known as the 3Vs, are:

- Volume
- Variety
- Velocity

These characteristics, and sometimes additional ones, have been generally adopted as the essential qualities of big data. The commonest fourth 'V' that is sometimes added is Veracity: is the data true and can its accuracy be relied upon?



Volume

The volume of big data held by large companies such as Walmart (supermarkets), Apple and EBay is measured in multiple petabytes. A typical disc on a personal computer (PC) holds a gigabyte, so the big data depositories of these companies hold at least the data that could typically be held on 1 million PCs, perhaps even 10 to 20 million PCs.

The scale of this is difficult to comprehend. It is probably more useful to consider the types of data that large companies will typically store.

Retailers
Via loyalty cards being swiped at checkouts: details of all purchases you make, when, where, how you pay, use of coupons.

Via websites: every product you have every looked at, every page you have visited, every product you have ever bought.

Social media (such as Facebook and Twitter)
Friends and contacts, postings made, your location when postings are made, photographs (that can be scanned for identification), any other data you might choose to reveal to the universe.

Mobile phone companies
Numbers you ring, texts you send (which can be automatically scanned for key words), every location your phone has ever been whilst switched on (to an accuracy of a few metres), your browsing habits. Voice mails.

Internet providers and browser providers
Every site and every page you visit. Information about all downloads and all emails (again these are routinely scanned to provide insights into your interests). Search terms which you enter.

Banking systems
Every receipt, payment, credit card information (amount, date, retailer, location), location of ATM machines used.

Variety

Some of the variety of information can be seen from the examples listed above. In particular, the following types of information are held:

- Browsing activities: sites, pages visited, membership of sites, downloads, searches
- Financial transactions
- Interests
- Buying habits

- Reaction to advertisements on the internet or to advertising emails
- Geographical information
- Information about social and business contacts
- Text
- Numerical information
- Graphical information (such as photographs)
- Oral information (such as voice mails)
- Technical information, such as jet engine vibration and temperature analysis

This data can be both structured and unstructured:

Structured data: this data is stored within defined fields (numerical, text, date etc) often with defined lengths, within a defined record, in a file of similar records. Structured data requires a model of the types and format of business data that will be recorded and how the data will be stored, processed and accessed. This is called a data model. Designing the model defines and limits the data which can be collected and stored, and the processing that can be performed on it.

An example of structured data is found in banking systems, which record the receipts and payments from your current account: date, amount, receipt/payment, short explanations such as payee or source of the money.

Structured data is easily accessible by well-established database structured query languages.

Unstructured data: refers to information that does not have a pre-defined data-model. It comes in all shapes and sizes and it is this variety and irregularity which makes it difficult to store in a way that will allow it to be analysed, searched or otherwise used. An often quoted statistic is that 80% of business data is unstructured, residing in word processor documents, spreadsheets, PowerPoint files, audio, video, social media interactions and map data.

Here is an example of unstructured data and an example of its use in a retail environment:

You enter a large store and have your mobile phone with you. That allows your movement round the store to be tracked. The store might or might not know who you are (depending on whether it knows your mobile phone number). The store can record what departments you visit, and how long you spend in each. Security cameras in the ceiling match up your image with the phone, so now they know what you look like and would be able to recognise you on future visits. You pass near a particular product and previous records show that you had looked at that product before, so a text message can be sent perhaps reminding you about it, or advertising a 10% price reduction. Perhaps the store has a marketing campaign

that states that it will never be undersold, so when you pass near products you might be making a price comparison and the store has to check prices on other stores websites and message you with a new price. If you buy the product then the store might have further marketing opportunities for related products and consumables and this data has to be recorded also. You pay with an affinity credit card (a card with associations with another organisation such as a charity or an airline), so now the store has some insight into your interests. Perhaps you buy several products and the store will want to discover if these items are generally bought together.

So just walking round a store can generate a vast quantity of data which will be very different in size and nature for every individual.

Velocity

Information must be provided quickly enough to be of use in decision-making and performance management. For example, in the above store scenario, there would be little use in obtaining the price-comparison information and texting customers once they had left the store. If facial recognition is going to be used by shops and hotels, it has to be more or less instant so that guests can be welcomed by name.

You will understand that the volume and variety conspire against velocity and, so, methods have to be found to process huge quantities of non-uniform, awkward data in real-time.

Processing and analysing big data

The processing of big data is generally known as big data **analytics** and includes:

- Data mining: analysing data to identify patterns and establish relationships such as associations (where several events are connected), sequences (where one event leads to another) and correlations.
- Predictive analytics: a type of data mining which aims to predict future events. For example, the chance of someone being persuaded to upgrade a flight.
- Text analytics: scanning text such as emails and word processing documents to extract useful information. It could simply be looking for key-words that indicate an interest in a product or place.
- Voice analytics: as above but with audio.
- Statistical analytics: used to identify trends, correlations and changes in behaviour.

The analytical findings can lead to:

- Better marketing
- Better customer service and relationship management

- Increased customer loyalty
- Increased competitive strength
- Increased operational efficiency
- Improved cost models
- The discovery of new sources of revenue.

Examples of the uses of big data

Netflix: this company began as a DVD mailing service and developed algorithms to help it to predict viewers' preferences and habits. Now it delivers films over the internet and can easily collect information about when movies are watched, how often films might be stopped and restarted, where they might be abandoned, and how users rate films. This allows Netflix to predict which films will be popular with which customers. It is also being used by Netflix to produce its own TV series, with much greater assurance that these will be hits.

Amazon: the world's leading e-retailer collects huge amounts of information about customers' preferences and habits which allow it to market very accurately to each customer. For example, it routinely makes recommendations to customers based on books or DVDs previously purchased.

Airlines: they know where you've flown, preferred seats, cabin class, when you fly, how often you search for a flight before booking, how susceptible you are to price reductions, probably which airline you might book with instead, whether you are returning with them but didn't fly out with them, whether car hire was purchased last time, what class of hotel you might book through their site, which routes are growing in popularity, seasonality of routes. They also know the profitability of each customer so that, for example, if a flight is cancelled they can help the most valuable customers first.

This information allows airlines to design new routes and timings, match routes to planes and also to make individualised offers to each potential passenger.

Target: Target is the second largest discount retailer in the USA. There is an often quoted story about their ability to predict when a customer is pregnant – frequently before the customer has informed her family. By looking at about 25 products it is claimed that they can create a pregnancy predictor. For example, early pregnancy often causes morning sickness so consumers would perhaps change to blander food and less perfumed shower gel. Why would Target be interested in knowing whether a consumer is pregnant? Well that person will require different products during the pregnancy then in a few months the baby will have its own product needs: nappies, baby shampoo and clothes. Early identification of pregnancy can allow Target to establish the shopping habits of the mother and perhaps even the preferences of the child.

Tesco: British supermarket group Tesco has operations in several countries around the world. In Ireland, the company developed a system to analyse the temperature of its in-store refrigerators. Sensors were placed in the fridges that measured the temperature every three seconds and sent the information over the internet to a central data warehouse. Analysis of this data allowed the company to identify units that were operating at incorrect temperatures. The company discovered that a number of fridges were operating at temperatures below the -21◦C to -23◦C recommended. This was clearly costing the company in terms of wasted energy. Having this information allowed the company to correct the temperature of the fridges. Given that the company was spending €10 million per year on fridge cooling costs in Ireland, an expected 20% reduction in these costs was a significant saving.

The system also allowed the engineers to monitor the performance of the fridges remotely. When they identified that a particular unit was malfunctioning, they could analyse the problem then visit the store with the right parts and replace them. Previously the fridges would only be fixed when a problem had been discovered by the store manager, which would usually be when the problem had developed into something more major. The engineers would have to visit the store, identify the problem, and then make a second visit to the store with the required parts.

Dangers/risks of big data

Despite the examples of the use of big data in commerce, particularly for marketing and customer relationship management, there are some potential dangers and drawbacks.

Cost: It is expensive to establish the hardware and analytical software needed, though these costs are continually falling.

Regulation: Some countries and cultures worry about the amount of information that is being collected and have passed laws governing its collection, storage and use. Breaking a law can have serious reputational and punitive consequences.

Loss and theft of data: Apart from the consequences arising from regulatory breaches as mentioned above, companies might find themselves open to civil legal action if data were stolen and individuals suffered as a consequence.

Incorrect data (veracity): If the data held is incorrect or out of date incorrect conclusions are likely. Even if the data is correct, some correlations might be spurious leading to false positive results.

Extracted from articles by Ken Garrett, a freelance lecturer and writer, and Nick Ryan, a subject matter expert for BPP

Chapter 3 Activity Based Costing

Executive Summary

Convention approach of absorption costing: The absorption rate is usually presented in terms of overhead cost per labour hour, or overhead cost per machine hour.

Instead of offering customers the ability to specify products, many companies offer an extensive range of products.

These developments in manufacturing and marketing mean that the conventional way of treating fixed overheads might not be good enough.

What we want to do is to get a more accurate estimate of what each unit costs to produce, and to do this we have to examine what activities are necessary to produce each unit, because activities usually have a cost attached. This is the basis of activity-based costing (ABC).

In addition to estimating more accurately the true cost of production, ABC will also give a better indication of where cost savings can be made.

Ken Garrett demystifies activity-based costing and provides some tips leading up to the all-important exams

Conventional costing distinguishes between variable and fixed costs. Typically, it is assumed that variable costs vary with the number of units of output (and that these costs are proportional to the output level) whereas fixed costs do not vary with output. This is often an over-simplification of how costs actually behave. For example, variable costs per unit often increase at high levels of production where overtime premiums might have to be paid or when material becomes scarce. Fixed costs are usually fixed only over certain ranges of activity, often stepping up as additional manufacturing resources are employed to allow high volumes to be produced.

Variable costs per unit can at least be measured, and the sum of the variable costs per unit is the marginal cost per unit. The marginal cost is the additional costs caused when one more unit is produced. However, there has always been a problem dealing with fixed production costs such as factory rent, heating, supervision and so on. Making a unit does not cause more fixed costs, yet production cannot take place without these costs being incurred. To say that the cost of producing a unit consists of marginal costs only will understate the true cost of production and this can lead to problems. For example, if the selling price is based on a mark-up on cost, then the company needs to make sure that all production costs are covered by the selling price. Additionally, focusing exclusively on marginal costs may cause companies to overlook important savings that might result from better controlled fixed costs.

Absorption costing

The conventional approach to dealing with fixed overhead production costs is to assume that the various cost types can be lumped together and a single overhead absorption rate derived. The absorption rate is usually presented in terms of overhead cost per labour hour, or overhead cost per machine hour. This approach is likely to be an over-simplification, but it has the merit of being relatively quick and easy.

Example 1

	A	B	C	D	E	F	G
1	**Table 1**						
2			**Ordinary**		**Deluxe**		
3	Budgeted units		20,000		2,000		
4							
5			$		$		
6	Material		10		12		
7	Labour		60		72		
8	Variable overhead		5		6		
9	Marginal cost		**75**		**90**		
10							
11							
12							

In Table 1 in the spreadsheet above, we are given the budgeted marginal cost for two products. Labour is paid at $12 per hour and total fixed overheads are $224,000. Fixed overheads are absorbed on a labour hour basis.

Based on Table 1 the budgeted labour hours must be 112,000 hours. This is derived from the budgeted outputs of 20,000 Ordinary units which each take five hours (100,000 hours) to produce, and 2,000 Deluxe units which each take six hours (12,000 hours).

Therefore, the fixed overhead absorption rate per labour hour is $224,000/112,000 = $2/hour.

The costing of the two products can be continued by adding in fixed overhead costs to obtain the total absorption cost for each of the products.

	A	B	C	D	E	F
1	**Table 1**					
2			**Ordinary**		**Deluxe**	
3	Budgeted units		20,000		2,000	
4						
5			$		$	
6	Material		10		12	
7	Labour		60		72	
8	Variable overhead		5		6	
9	Marginal cost		**75**		**90**	
10	Fixed overheads		10		12	
11	Total production cost		**85**		**102**	
12						
13						
14						

Table 1 has been amended to include the fixed overheads to be absorbed in both products.

Ordinary: (5 labour hours x $2 OAR) = $10

Deluxe: (6 labour hours x $2 OAR) = $12

This means we have arrived at the total production cost for both products under absorption costing. It also tell us that if production goes according to budget then total costs will be (20,000 x $85) + (2,000 x $102) = $1,904,000.

The conventional approach outlined above is satisfactory if the following conditions apply:

1. Fixed costs are relatively immaterial compared to material and labour costs. This is the case in manufacturing environments which do not rely on sophisticated and expensive facilities and machinery.
2. Most fixed costs accrue with time.
3. There are long production runs of identical products with little customisation.

However, much modern manufacturing relies on highly automated, expensive manufacturing plants – so much so that some companies do not separately identify the cost of labour because there is so little used. Instead, factory labour is simply regarded as a fixed overhead and added in to the fixed costs of running the factory, its machinery, and the sophisticated information technology system which coordinates production.

Additionally, many companies rely on customisation of products to differentiate themselves and to enable higher margins to be made. Dell, for example, a PC manufacturer, has a website which lets customers specify their own PC in terms of memory size, capacity, processor speed etc. That information is then fed into their automated production system and the specified computer is built, more or less automatically.

Instead of offering customers the ability to specify products, many companies offer an extensive range of products, hoping that one member of the range will match the requirements of a particular market segment. In Example 1, the company offers two products: Ordinary and Deluxe. The company knows that demand for the Deluxe range will be low, but hopes that the price premium it can charge will still allow it to make a good profit, even on a low volume item. However, the Deluxe product could consume resources which are not properly reflected by the time it takes to make those units.

These developments in manufacturing and marketing mean that the conventional way of treating fixed overheads might not be good enough. Companies need to know the causes of overheads, and need to realise that many of their 'fixed costs' might not be fixed at all. They need to try to assign costs to products or services on the basis of the resources they consume.

Activity-based costing

What we want to do is to get a more accurate estimate of what each unit costs to produce, and to do this we have to examine what activities are necessary to produce each unit, because activities usually have a cost attached. This is the basis of activity-based costing (ABC).

The old approach of simply pretending that fixed costs are incurred because of the passage of time, and that they can therefore be accounted for on the basis of labour (or machine) time spent on each unit, is no longer good enough. Diverse, flexible manufacturing demands a more accurate approach to costing.

The ABC process is as follows:

1. Split fixed overheads into activities. These are called cost pools.
2. For each cost pool identify what causes that cost. In ABC terminology, this is the 'cost driver', but it might be better to think of it as the 'cost causer'.
3. Calculate a cost per unit of cost driver (Cost pool/total number of cost driver).
4. Allocate costs to the product based on how much the product uses of the cost driver.

Let's continue with our example from earlier; the total fixed overheads were $224,000. In the table below in Example 2 the total overheads have been split into cost pools and cost driver data for the Ordinary and Deluxe products has been collated.

Example 2

	A	B	C	D
1				
2	**Cost pool**	**$**		
3	Batch set-ups	90,000		
4	Stores/material handling	92,000		
5	Other (rent etc.)	42,000		
6	Total	**224,000**		
7				
8	**Cost driver data**	**Ordinary**	**Deluxe**	
9	Batch size	2,000	100	
10	Number of components per unit	20	30	
11				
12				

If we apply the ABC process we can see that Step 1 is complete as we know what the cost pools are.

For Step 2 we need to identify the cost driver for each cost pool.

Batch set-up costs will be driven by the number of set-ups required for production:

Ordinary: 20,000/2,000 = 10 Deluxe units: 2,000/100 = 20 Total set-ups: 30

Stores/material handling costs will be driven by the number of components required for production:

Ordinary: (20,000 units x 20) = 400,000 Deluxe: (2,000 units x 30) = 60,000 Total components = 460,000

Other fixed overheads will have to be absorbed on a labour hour basis because there is no information provided which would allow a better approach. We know from Example 1 that total labour hours required are 112,000.

In Step 3 we need to calculate a cost per unit of cost driver.

Batch set-ups: $90,000/30 = $3,000/set-up Stores/material handling: $92,000/460,000 = $0.20/component

Other overheads: $42,000/112,000 = $0.375/labour hour

Step 4 then requires us to use the costs per unit of cost driver to absorb costs into each product based on how much the product uses of the driver.

Batch set-ups: Ordinary: ($3,000/2,000 units) = $1.50/unit Deluxe: ($3,000/100 units) = $30/unit

Store/material handling: Ordinary: ($0.20 x 20 components) = $4/unit Deluxe: ($0.20 x 30 components) = $6/unit

Other overheads: Ordinary: ($0.375 x 5 hours) = $1.875/unit Deluxe: ($0.375 x 6 hours) = $2.25/unit

The ABC approach to costing therefore results in the figures shown in the spreadsheet below.

	A	B	C	D
1				
2		**Ordinary**	**Deluxe**	
3	Marginal costs (as before)	75.00	90.00	
4	Overheads:			
5	Batch set-ups	1.50	30.00	
6	Material handling	4.00	6.00	
7	Other	1.875	2.25	
8	**Total production cost**	**82.375**	**128.25**	
9				
10	Comparison			
11	Full production cost (AC)	85.00	**102.00**	
12	Full production cost (ABC)	82.375	128.25	
13				

Check: If production goes according to budget total costs will be (20,000 x $82.375) + (2,000 x $128.25) = $1,904,000

If you look at the comparison of the full cost per unit in the spreadsheet above, you will see that the ABC approach substantially increases the cost of making a Deluxe unit. This is primarily because the Deluxe units are made in small batches. Each batch causes an expensive set-up, but that cost is then spread over all the units produced in that batch – whether few (Deluxe) or many (Ordinary). It can only be right that the effort and cost incurred in producing small batches is reflected in the cost per unit produced. There would, for example, be little point in producing Deluxe units at all if their higher selling price did not justify the higher costs incurred.

In addition to estimating more accurately the true cost of production, ABC will also give a better indication of where cost savings can be made. Remember, the title of this exam is *Performance Management*, implying that accountants should be proactive in improving performance rather than passively measuring costs. For example, it's clear that a substantial part of the cost of producing Deluxe units is set-up costs (almost 25% of the Deluxe units' total costs).

Working on the principle that large cost savings are likely to be found in large cost elements, management's attention will start to focus on how this cost could be reduced.

For example, is there any reason why Deluxe units have to be produced in batches of only 100? A batch size of 200 units would dramatically reduce those set-up costs.

The traditional approach to fixed overhead absorption has the merit of being simple to calculate and apply. However, simplicity does not justify the production and use of information that might be wrong or misleading.

ABC undoubtedly requires an organisation to spend time and effort investigating more fully what causes it to incur costs, and then to use that detailed information for costing purposes. But understanding the drivers of costs must be an essential part of good performance management.

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Questions

The following statements have been made about Activity Based Costing (ABC):
(1) Introducing ABC will always reduce costs in the short term;
(2) If the cost of a product or service using both ABC and absorption costing is the same, there will be no benefit to be gained from adopting ABC.

Which of the statements is/are correct?

A 1 only
B 2 only
C Neither 1 nor 2
D Both 1 and 2

Answer: C

(1) is incorrect as some costs will be fixed in the short term. For such costs, it will only be possible to achieve a reduction in the long term.

(2) is incorrect as ABC will provide a greater insight into the causes of costs. This will allow managers to exercise greater control of costs by focusing attention on managing the causes of costs.

Chapter 4 Target Costing and Lifecycle Costing

Executive Summary

There are two flaws in this approach:

- The product's price is based on its cost, but no-one might want to buy at that price.
- The costs incorporated are the current costs only. To make a profit, total revenue must exceed total costs in the long-term.

Target costing is very much a marketing approach to costing.

An emphasis on the planning and design stage. This becomes very important to the cost of the product because if something is designed such that it is needlessly expensive to make, it does not matter how efficient the production process is, it will always be a struggle to make satisfactory profits.

When seeking to make a profit on a product it is essential that the total revenue arising from the product exceeds total costs, whether these costs are incurred before, during or after the product is produced. This is the concept of life cycle costing.

Ken Garrett explains target costing and lifecycle costing, and gives examples as to how and when you would use these costing techniques

Target costing and lifecycle costing can be regarded as relatively modern advances in management accounting, so it is worth first looking at the approach taken by conventional costing.

Typically, conventional costing attempts to work out the cost of producing an item incorporating the costs of resources that are currently used or consumed. Therefore, for each unit made the classical variable costs of material, direct labour and variable overheads are included (the total of these is the marginal cost of production), together with a share of the fixed production costs. The fixed production costs can be included using a conventional overhead absorption rate (absorption costing (AC)) or they can be accounted for using activity-based costing (ABC). ABC is more complex but almost certainly more accurate. However, whether conventional overhead treatment or ABC is used the overheads incorporated are usually based on the budgeted overheads for the current period.

Once the total absorption cost of units has been calculated, a mark-up (or gross profit percentage) is used to determine the selling price and the profit per unit. The mark-up is chosen so that if the budgeted sales are achieved, the organisation should make a profit.

There are two flaws in this approach:

1. The product's price is based on its cost, but no-one might want to buy at that price. The product might incorporate features which customers do not value and therefore do not want to pay for, and competitors' products might be cheaper, or at least offer better value for money. This flaw is addressed by target costing.
2. The costs incorporated are the current costs only. They are the marginal costs plus a share of the fixed costs for the current accounting period. There may be other important costs which are not part of these categories, but without which the goods could not have been made. Examples include the research and development costs and any close down costs incurred at the end of the product's life. Why have these costs been excluded, particularly when selling prices have to be high enough to ensure that the product makes an overall profit for the company. To make a profit, total revenue must exceed total costs in the long-term. This flaw is addressed by lifecycle costing.

Target costing

Target costing is very much a marketing approach to costing. The Chartered Institute of Marketing defines marketing as:

'The management process responsible for identifying, anticipating and satisfying customer requirements profitably.'

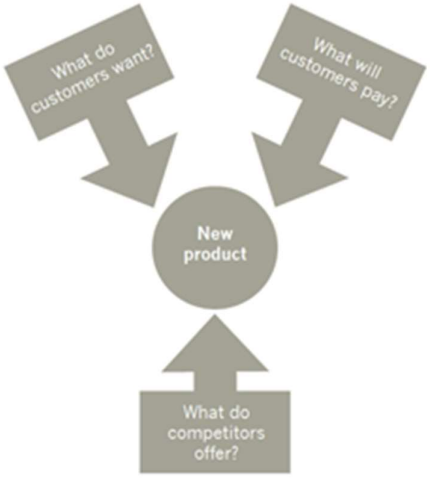
In marketing, customers rule, and marketing departments attempt to find answers to the following questions:

- Are customers homogeneous or can we identify different segments within the market?
- What features does each market segment want in the product?
- What price are customers willing to pay?
- To what competitor products or services are customers comparing ours?
- How will we advertise and distribute our products? (There are costs associated with those activities too)

Marketing says that there is no point in management, engineers and accountants sitting in darkened rooms dreaming up products, putting them into production, adding on, say 50% for mark-up then hoping those products sell. At best this is corporate arrogance; at worst it is corporate suicide.

Note that marketing is not a passive approach, and management cannot simply rely on customers volunteering their ideas. Management should anticipate customer requirements, perhaps by developing prototypes and using other market research techniques.

Therefore really important information relating to a new product is:



Of course, there will probably be a range of products and prices, but the company cannot dictate to the market, customers or competitors. There are powerful constraints on the product and its price and the company has to make the required product, sell it at an acceptable and competitive price and, at the same time, make a profit. If the profit is going to be adequate, the costs have to be sufficiently low. Therefore, instead of starting with the cost and working to the selling price by adding on the expected margin, target costing will start with the selling price of a particular product and work back to the cost by removing the profit element. This means that the company has to find ways of not exceeding that cost.

Example: If a company normally expects a mark-up on cost of 50% and estimates that a new product will sell successfully at a price of $12, then the maximum cost of production should be $8:

Cost 100% $8				
	+	Mark-up 50% $4	=	Selling price 150% $12

This is a powerful discipline imposed on the company. The main results are:

- The establishment of multifunctional teams consisting of marketing people, cost accountants, production managers, quality control professionals and others. These teams are vital to the design and manufacturing decisions required to determine the price and feature combinations that are most likely to appeal to potential buyers of products.
- An emphasis on the planning and design stage. This becomes very important to the cost of the product because if something is designed such that it is needlessly expensive to make, it does not matter how efficient the production process is, it will always be a struggle to make satisfactory profits.

Here are some of the decisions, made at the design stage, which can affect the cost of a product:

- the features of the product
- how to avoid ‘over design’
- the number of components needed
- whether the components are standard or specialised
- the complexity of machining and construction
- where the product can be made
- what to make in-house and what to sub-contract
- the quality of the product
- the batch size in which the product can be made

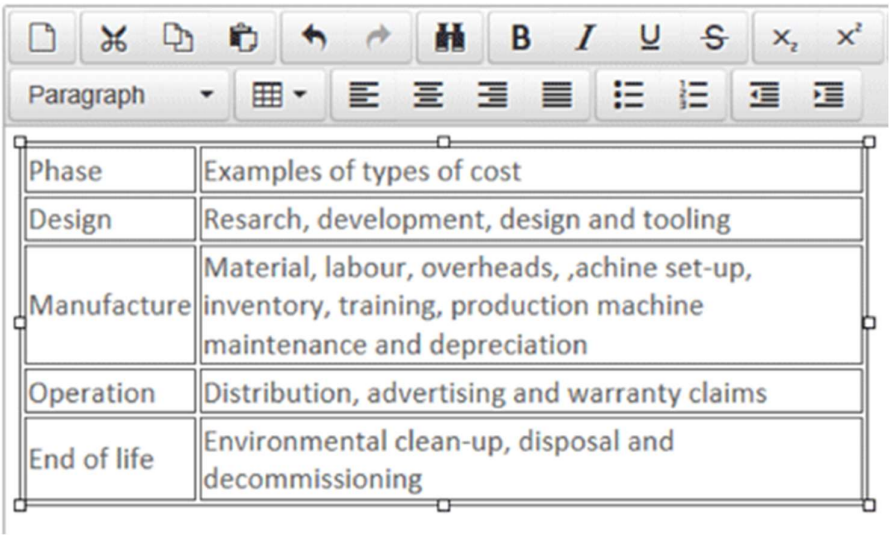
You will see from this list that activity-based costing can also play an important part in target costing. By understanding the cost drivers (cost causers) a company can better control its costs. For example, costs could be driven down by increasing batch size, or reducing the number of components that have to be handled by stores. The concept of value engineering (or value analysis) can be important here. Value engineering aims to reduce costs by identifying those parts of a product or service which do not add value – where ‘value’ is made up of both:

- use value (the ability of the product or service to do what it sets out to do – its function) and
- esteem value (the status that ownership or use confers)

The aim of value engineering is to maximise use and esteem values while reducing costs. For example, if you are selling perfume, the design of its packaging is important. The perfume could be held in a plain glass (or plastic) bottle, and although that would not damage the use value of the product, it would damage the esteem value. The company would be unwise to try to reduce costs by economising too much on packaging. Similarly, if a company is trying to reduce the costs of manufacturing a car, there might be many components that could be satisfactorily replaced by cheaper or simpler ones without damaging either use or esteem values. However, there will be some components that are vital to use value (perhaps elements of the suspension system) and others which endow the product with esteem value (the quality of the paint and the upholstery).

Lifecycle costing

As mentioned above, target costing places great emphasis on controlling costs by good product design and production planning, but those up-front activities also cause costs. There might be other costs incurred after a product is sold such as warranty costs and plant decommissioning. When seeking to make a profit on a product it is essential that the total revenue arising from the product exceeds total costs, whether these costs are incurred before, during or after the product is produced. This is the concept of life cycle costing, and it is important to realise that target costs can be driven down by attacking any of the costs that relate to any part of a product's life. The cost phases of a product can be identified as:



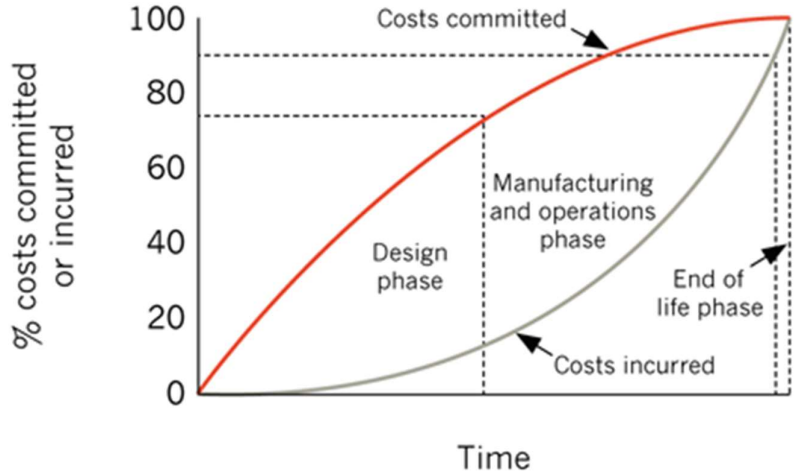
Phase	Examples of types of cost
Design	Resarch, development, design and tooling
Manufacture	Material, labour, overheads, ,achine set-up, inventory, training, production machine maintenance and depreciation
Operation	Distribution, advertising and warranty claims
End of life	Environmental clean-up, disposal and decommissioning

There are four principal lessons to be learned from lifecycle costing:

- All costs should be taken into account when working out the cost of a unit and its profitability.
- Attention to all costs will help to reduce the cost per unit and will help an organisation achieve its target cost.
- Many costs will be linked. For example, more attention to design can reduce manufacturing and warranty costs. More attention to training can machine maintenance costs. More attention to waste disposal during manufacturing can reduce end-of life costs.

- Costs are committed and incurred at very different times. A committed cost is a cost that will be incurred in the future because of decisions that have already been made. Costs are incurred only when a resource is used.

Typically, the following pattern of costs committed and costs incurred is observed:



The diagram shows that by the end of the design phase approximately 80% of costs are committed. For example, the design will largely dictate material, labour and machine costs. The company can try to haggle with suppliers over the cost of components but if, for example, the design specifies 10 units of a certain component, negotiating with suppliers is likely to have only a small overall effect on costs. A bigger cost decrease would be obtained if the design had specified only eight units of the component. The design phase locks the company in to most future costs and it this phase which gives the company its greatest opportunities to reduce those costs.

Conventional costing records costs only as they are incurred, but recording those costs is different to controlling those costs and performance management depends on cost control, not cost measurement.

A numerical example of target and lifecycle costing

A company is planning a new product. Market research information suggests that the product should sell 10,000 units at $21.00/unit. The company seeks to make a mark-up of 40% product cost. It is estimated that the lifetime costs of the product will be as follows:

1. Design and development costs $50,000
2. Manufacturing costs $10/unit
3. End of life costs $20,000

The company estimates that if it were to spend an additional £15,000 on design, manufacturing costs/unit could be reduced.

Required: (a) What is the target cost of the product? (b) What is the original lifecycle cost per unit and is the product worth making on that basis? (c) If the additional amount were spent on design, what is the maximum manufacturing cost per unit that could be tolerated if the company is to earn its required mark-up?

Solution: The target cost of the product can be calculated as follows:

(a)

Cost 100% $15	+	Mark-up 40% $6	=	Selling price 140% $21

(b) The original life cycle cost per unit = ($50,000 + (10,000 x $10) + $20,000)/10,000 = $17

This cost/unit is above the target cost per unit, so the product is not worth making.

(c) Maximum total cost per unit = $15. Some of this will be caused by the design and end of life costs:

($50,000 + $15,000 + $20,000)/10,000 = $8.50

Therefore, the maximum manufacturing cost per unit would have to fall from $10 to ($15 – $8.50) = $6.50.

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Questions

(1)

The selling price of Product X is set at $550 for each unit and sales for the coming year are expected to be 800 units. A return of 30% on the investment of $500,000 in Product X will be required in the coming year.

What is the target cost for each unit of Product X?

A $385·00
B $165·00
C $187·50
D $362·50

Answer: D

Return: $500,000 x 30% = $150,000
Total sales revenue = $550 x 800 = $440,000
Therefore total cost = $440,000 – $150,000 = $290,000
Unit cost = $290,000/800 = $362·50

(2)

Which of the following costs would be included in the life cycle costs of a product?
(1) Planning and concept design costs
(2) Proto-type testing costs
(3) Product manufacturing costs
(4) Distribution and customer service costs

A 1, 2, 3 and 4
B 2, 3 and 4 only
C 1, 2 and 4 only
D 1, 3 and 4 only

Answer: A

Lifecycle costing aims to obtain more accurate product costs by including all costs incurred over the life of a product.

Chapter 5 Throughput Accounting and the Theory of Constraints – Part 1

Executive Summary

This article extracts the key concepts from a book, *The Goal: A Process of Ongoing Improvement* by Eli Goldratt and Jeff Cox, on throughput accounting and the theory of constraints.

The importance of considering an organisation's goal

“increasing throughput whilst simultaneously reducing inventory and operational expense”

- ‘throughput’ is the rate at which the system generates money through sales
- ‘inventory’ is all the money that the system has invested in purchasing things that it intends to sell
- ‘operational expense’ is all the money that the system spends in order to turn inventory into throughput

Working out how to achieve the goal

Statistical fluctuations and dependent events

Identifying bottlenecks

Elevating bottlenecks

- An important lesson: an hour lost on a bottleneck machine is an hour lost for the entire system.

The need to accept idle time

Throughput and just-in-time

A member of the Performance Management examining team shares her latest read and how it changed her views on throughput accounting and the theory of constraints.

I've just finished reading a book. It was the type of book that you pick up and you cannot put down (other than to perform the mandatory tasks that running a house and looking after a family entail). Even the much-awaited new series of one of my favourite television programmes couldn't tempt me away from my book.

Now obviously I'm telling you this for a reason. I love reading and it's not unusual to find me glued to a book for several days, if it's a good one. But you've gathered by now that the book I've been reading was not the usual Man Booker or Orange prize fiction novel that you might ordinarily find tucked away in my handbag. It was in fact *The Goal: A Process of Ongoing Improvement* by Eli Goldratt and Jeff Cox. If by now you've settled quickly into the belief that I must conform to society's expectations of your typical 'number crunching' accountant of which – by the way – I've met few in reality, you are wrong. So what then, you may ask, makes this book so different from the image that the title conjures up? Let me tell you all about it.

The Goal, originally published back in 1984, presents the theory of constraints and throughput accounting within the context of a novel. It tells the story of Alex Rogo, a plant manager at a fictional manufacturing company called UniCo, which is facing imminent closure unless Alex can turn the loss-making plant into a profitable one within three months. In his attempt to do so, Alex is forced to question the whole belief in the US at the time that success in manufacturing is represented by a 100% efficient factory (ie everyone and every machine is busy 100% of the time), which keeps cost per unit as low as possible.

To be honest, before I read the book, I wasn't really convinced about throughput accounting – although the theory of constraints has always made perfect sense to me. But, having read about both in the context of a very believable plant that was representative of many at the time, my views have changed. It's easy to stand in a classroom and lecture about throughput accounting and criticise it for being 'nothing new', but what we have to remember is, back in 1984, this was new, and for those companies that adopted it, it made a huge difference.

I'm aware that, if I want you to share my renewed interest in throughput accounting, I need to tell you more about the story that gripped me. If I don't do this, you'll just go away having read yet another article about throughput accounting, and any doubts that you have about its relevance today will remain the same. On the other hand, I'm also aware that, when sitting professional exams, you need to have a working knowledge of throughput accounting that you can apply in the exam hall. Consequently, I've decided that, in this first article, I'll summarise the story contained in *The Goal*, bringing out some of the basic principles of the theory of constraints and throughput accounting. Then, in the second article, I'll talk you through a practical approach to questions on throughput accounting.

The importance of considering an organisation's goal

Alex Rogo's journey begins with a chance meeting with his old physics teacher, Jonah, at an airport, after attending a conference about robotics. This is just before Alex finds out about the threat of closure at the plant. The UniCo factory has been using robotic machines for some time now and Alex is proudly telling Jonah about the improvements in efficiency at the factory. Jonah is quick to question whether these improvements in efficiency have actually led to an improvement in profits. Alex is confused by the way the conversation is going. This confusion is reflective of the US thinking at the time. There is so much focus on efficiency and reducing labour costs with increased automation, but without consideration of whether either of these things are having any impact on profit. In the case of UniCo – and indeed many other real factories at the time – the so-called improvements in efficiency are not leading to increased profits. In fact, they seem to be leading to losses.

Jonah leads Alex to consider what the goal of UniCo really is. Until this point, he – like his superiors at Head Office – has just assumed that if the factory is producing increasingly more parts at a lower unit cost, it is increasingly efficient and therefore must be doing well. All the performance criteria that the business is using support this view; all Alex's bosses are concerned about seems to be cost efficiencies.

After some reflection, Alex realises that the overriding goal of an organisation is to make money. Just because a factory is making more parts does not mean to say that it is making more money. In fact, UniCo shows that just the opposite is happening. The plant has become seemingly more efficient, thanks to the use of the robots, but the fact is that inventory levels are huge and the plant is constantly failing to meet order deadlines. It is standard practice for orders to be five or six months late. An order at the plant only ever seems to go out when one of the customers loses patience and complains loudly, resulting in the order being expedited – ie all other work is put on hold in order to get the one order out. Customers are becoming increasingly dissatisfied, losses are growing, and crisis point is reached.

Clearly, the 'goal' that the objective of the plant is to make money needs to be more clearly defined, in order to generate improvements, and Jonah helps Alex do this by explaining that it will be achieved by 'increasing throughput whilst simultaneously reducing inventory and operational expense'. Some definitions are given at this point:

- 'throughput' is the rate at which the system generates money through sales
- 'inventory' is all the money that the system has invested in purchasing things that it intends to sell
- 'operational expense' is all the money that the system spends in order to turn inventory into throughput

Working out how to achieve the goal

Having worked out what the goal is, Alex is then left with the difficult task of working out how that goal can be achieved. The answer begins to present itself to Alex when he takes his son and some other boys on a 10-mile hike. Given that the average boy walks at two miles an hour, Alex expects to reach the halfway point on the hike after about two and a half hours of walking. When this doesn't happen, and Alex finds that the group is behind schedule and big gaps are appearing between them, he begins to question what is going on. He soon realises that the problem is arising because one of the boys is much slower than the others. This boy is preventing the other boys from going faster and Alex realises that, if everyone is to stay in one group as they must, the group can only go as fast as their slowest walker. The slow walker is effectively a bottleneck: the factor that prevents the group from going faster. It doesn't matter how fast the quickest walker is; he cannot make up for the fact that the slowest walker is really slow. While the average speed may be two miles per hour, the boys can all only really walk at the speed of the slowest boy.

However, Alex also realises that they can increase the boy's speed by sharing out the heavy load he is carrying in his bag, enabling him to walk faster. In this way, they can 'elevate the bottleneck' – ie increase the capacity of the critical resource. Alex cannot wait to get back and identify where the bottlenecks are happening in his factory and find out if they can be elevated in any way, without laying out any capital expenditure.

Statistical fluctuations and dependent events

The other thing that Alex gains a better understanding of on the hike is the relationship between dependent events and statistical fluctuations. Jonah has already explained to Alex that the belief that a balanced plant is an efficient plant is a flawed belief. In a balanced plant, the capacity of each and every resource is balanced exactly with the demand from the market. In the 1980s, it was deemed to be ideal because, at the time, manufacturing managers in the Western world believed that, if they had spare capacity, they were wasting money. Therefore, they tried to trim capacity wherever they could, so that no resource was idle and everybody always had something to work on. However, as Jonah explains, when capacity is trimmed exactly to marketing demand, throughput goes down and inventory goes up. Since inventory goes up, the cost of carrying it – ie operational expense also goes up. These things happen because of the combination of two phenomena: dependent events and statistical fluctuations.

The fact that one boy walks at three miles an hour and one boy walks at one mile an hour on the hike is evidence of statistical fluctuations. But the actual opportunity for the higher fluctuation of three miles an hour to occur is limited by the constraint of the one mile per hour walker. The fast boy at the front of the group can only keep on walking ahead if the other boys are also with him – ie he is dependent on them catching up if he is to reach his three mile per hour speed. Where there are dependent events, such as this, the opportunity for higher fluctuations is limited. Alex takes this knowledge back to the factory with him and sets about rescuing his plant.

Identifying bottlenecks

Back at the plant, Alex and his team set out to identify which machines at the plant are the bottleneck resources. After talking to staff and walking around the factory, where there are big piles of inventory sitting in front of two main machines, the bottlenecks become obvious. Eighty per cent of parts have to go through these machines, and the team make sure that all such parts are processed on the non-bottleneck machines in priority to the other 20% of parts, by marking them up with a red label. The parts that don't go through the bottlenecks are marked with a green label. The result? Throughput increases. But the problem? Unfortunately, it doesn't increase enough to save the factory.

Elevating bottlenecks

The next step is therefore to try and elevate the capacity of the bottlenecks. This is not easy without spending money, but observation shows that, at times, the bottleneck machines are sometimes still idle, despite the labelling system giving priority to the parts that have to be ready to go through the bottleneck machines. This is partly because workers are taking their breaks before getting the machines running again, and partly because they have left the machines unmanned because they have been called away to work on another (non-bottleneck) machine. Both of these absences result in the machines becoming idle. At this point, Alex learns an important lesson: an hour lost on a bottleneck machine is an hour lost for the entire system. This hour can never be recouped. It is pointless to leave a bottleneck machine unmanned in order to go and load up a non-bottleneck machine because there is spare capacity on the non-bottleneck machine anyway. It doesn't matter if it's not running for a bit. But it does matter in the case of the bottleneck. From this point onwards, the two bottlenecks are permanently manned and permanently running. Their capacity is elevated this way, along with another few changes that are implemented.

The need to accept idle time

At this point, Alex and his team think they have saved the factory, and then suddenly they find that new bottlenecks seem to be appearing. Parts with green labels on are not being completed in sufficient quantities, meaning that final assembly of the company's products is again not taking place, and orders are being delayed again (because final assembly of products requires both bottleneck and non-bottleneck parts). Alex calls Jonah in a panic and asks for help. Jonah soon identifies the problem. Factory workers are still trying to be as efficient as possible, all of the time. This means that they are getting their machines to produce as many parts as possible, irrespective of the number of parts that can actually be processed by the bottleneck.

Jonah begins to explain, labelling a bottleneck machine as X and a non-bottleneck machine as Y. Some products may not need to go through X, he says, but that doesn't mean that workers should make as many parts as the machines can produce, just to keep the machine's efficiency rate looking good. Y parts should only be produced to the extent that they can be used in the assembly of finished goods, and the production of these is constrained by their need for bottleneck parts too. Any excess Y parts will simply go to the warehouse and be stored as finished goods, ultimately becoming obsolete and having to be written off at a substantial cost.

As for those products that do need to go through X, they may, for example, go from Y to Y to X to Y (as there are numerous steps involved in the production process). But if the capacity of the first Y machine is far higher than the capacity of the next Y machine, and it processes excessive X parts, another bottleneck may look like it has appeared on the second Y machine because so many red labelled parts are being fed through that it never gets to process the green ones, which are also necessary for final assembly. Suddenly Alex realises that all machines must work at the pace set by the bottleneck machines, just like the boys on the hike that had to walk at the pace of the slowest walker.

Consequently, Alex realises that it is really important to let Y machines and workers sit idle when they have produced to the capacity of the bottleneck machines. By definition, they have spare capacity. It's not only wasteful to produce parts that are not needed or cannot be processed; it also clogs up the whole system and makes it seem as if new bottlenecks are appearing. This idea of idle time not only being acceptable but also being essential flies in the face of everything that is believed at the time and, yet, when you understand the theory of constraints, it makes perfect sense. A balanced factory is not efficient at all; it is very inefficient because different machines and processes have different capacities, and if machines that have spare capacity are working 100% of the time, they are producing parts that are not needed. This is wasteful, not efficient. As evidenced in the novel, inventory goes up and throughput goes down. Alex is quick to resolve the problem and get things running smoothly again.

Throughput and just-in-time

Given that producing excess inventories both pushes costs up and prevents throughput, it becomes obvious that throughput accounting and just in time operate very well together. This becomes clear towards the end of the novel when UniCo secures even more orders by reducing its delivery time dramatically. It is able to do this by adopting some of the principles of just-in-time.

First, Alex reduces batch sizes substantially. For those unfamiliar with throughput accounting and just-in-time, it can be hard to get past the idea that if batch sizes are halved, financial results may still improve. The novice believes that if batch sizes are halved, costs must go up, because more orders are needed, more set ups are needed, more deliveries are needed, and so on... and surely these costs must be high? But the fact is – as proved in the novel – inventory costs are also halved and, even more importantly, lead time is halved, which in this case gives UniCo a competitive advantage. Throughput increases dramatically because of increased sales volumes. These increased sales volumes also led to a significantly lower operating cost per unit, which, along with the reduced inventory costs, more than makes up for increase in the other costs. Given that there is spare capacity for all of the non-bottleneck machines anyway, if the number of set ups for these is increased, no real additional cost arises because there is idle time. As Jonah says: 'An hour saved on a non-bottleneck resource is a mirage.'

Conclusion

It is not possible, within the space of a few pages, to convey everything that The Goal has to say. To think that I could do so would be an insult to the authors of this 273-page novel. Nor is the theory contained within the novel beyond questioning and criticism; but this article was not meant as a critique.

Hopefully, however, I have told you enough to convince you that this book is worth reading should you have a couple of days to spare sometime. I haven't, after all, told you the ending... Also, you should now have an understanding of the background to part 2 of this article (see 'Related links').

Written by a member of the Performance Management examining team

Chapter 6 Throughput Accounting and the Theory of Constraints – Part 2

Executive Summary

Theory of constraints

The five focusing steps

- Step 1: Identify the system's bottlenecks
- Step 2: Decide how to exploit the system's bottlenecks
- Step 3: Subordinate everything else to the decisions made in Step 2
- Step 4: Elevate the system's bottlenecks
- Step 5: If a new constraint is broken in Step 4, go back to Step 1, but do not let inertia become the system's new bottleneck

Ratios

1. Return per factory hour = Throughput per unit / product time on bottleneck resource.

2. Cost per factory hour = Total factory costs / total time available on bottleneck resource.

3. Throughput accounting ratio (TPAR) = Return per factory hour/cost per factory hour.

In the previous article, a member of the Performance Management examining team revealed all about *The Goal*, the book in which the theory of constraints and throughput accounting were introduced in the context of a novel. In this second article, she sets out the five focusing steps of the theory of constraints, briefly explaining each one and then will go through two examples showing you how these steps might be applied in practice or in exam questions. It's worth noting at this stage that, while the theory of constraints and throughput accounting were introduced in *The Goal*, they were further developed by Goldratt later.

The five focusing steps

The theory of constraints is applied within an organisation by following what are called 'the five focusing steps.' These are a tool that Goldratt developed to help organisations deal with constraints, otherwise known as bottlenecks, within the system as a whole (rather than any discrete unit within the organisation.) The steps are as follows:

Step 1: Identify the system's bottlenecks Often, in exam questions, you will be told what the bottleneck resource is. If not, it is usually quite simple to work out. For example, let's say that an organisation has market demand of 50,000 units for a product that goes through three processes: cutting, heating and assembly. The total time required in each process for each product and the total hours available are:

Process	Cutting	Heating	Assembly
Hours per unit	2	3	4
Total hours available	100,000	120,000	220,000

The total time required to make 50,000 units of the product can be calculated and compared to the time available in order to identify the bottleneck.

Process	Cutting	Heating	Assembly
Hours per unit	2	3	4
Total hours required for 50,000 units	100,000	150,000	200,000
Total hours available	100,000	120,000	220,000
Shortfall in hours	0	30,000	0

It is clear that the heating process is the bottleneck. The organisation will in fact only be able to produce 40,000 units (120,000/3) as things stand.

Step 2: Decide how to exploit the system's bottlenecks This involves making sure that the bottleneck resource is actively being used as much as possible and is producing as many units as possible. So, 'productivity' and 'utilisation' are the key words here. In '*The Goal*', Alex noticed that the NCX 10 was sometimes dormant and immediately changed this by making sure that set ups took place before workers went on breaks, so that the machines were always left running. Similarly, the furnaces were sometimes left idle for extended periods before the completed parts were unloaded and new parts were put in. This was because workers were being called away to work on non-bottleneck machines, rather than being left standing idle while waiting for the furnaces to heat the parts. This was addressed by making sure that there were always workers at the furnaces, even if they had nothing to do for a while.

Step 3: Subordinate everything else to the decisions made in Step 2 The main point here is that the production capacity of the bottleneck resource should determine the production schedule for the organisation as a whole. Remember how, in the previous article, I talked about how new bottlenecks seemed to be appearing at the UniCo plant, because non-bottleneck machines were producing more parts than the bottleneck resources could absorb? Idle time is unavoidable and needs to be accepted if the theory of constraints is to be successfully applied. To push more work into the system than the constraint can deal with results in excess work-in-progress, extended lead times, and the appearance of what looks like new bottlenecks, as the whole system becomes clogged up. By definition, the system does not require the non-bottleneck resources to be used to their full capacity and therefore they must sit idle for some of the time.

Step 4: Elevate the system's bottlenecks In *The Goal*, Alex was initially convinced that there was no way to elevate the capacities of the NCX 10 machine and the furnace without investing in new machinery, which was not an option. Jonah made him and his team think about the fact that, while the NCX 10 alone performed the job of three of the old machines, and was very efficient at doing that job, the old machines had still been capable of producing parts. Admittedly, the old machines were slower but, if used alongside the NCX 10, they were still capable of elevating production levels. Thus, one of Alex's staff managed to source some of these old machines from one of UniCo's sister plants; they were sitting idle there, taking up factory space, so the manager was happy not to charge Alex's plant for the machines. In this way, one of the system's bottlenecks was elevated without requiring any capital investment.

This example of elevating a bottleneck without cost is probably unusual. Normally, elevation will require capital expenditure. However, it is important that an organisation does not ignore Step 2 and jumps straight to Step 4, and this is what often happens. There is often untapped production capacity that can be found if you look closely enough. Elevation should only be considered once exploitation has taken place.

Step 5: If a new constraint is broken in Step 4, go back to Step 1, but do not let inertia become the system's new bottleneck When a bottleneck has been elevated, a new bottleneck will eventually appear. This could be in the form of another machine that can now process less units than the elevated bottleneck. Eventually, however, the ultimate constraint on the system is likely to be market demand. Whatever the new bottleneck is, the

message of the theory of constraints is: never get complacent. The system should be one of ongoing improvement because nothing ever stands still for long.

I am now going to have a look at an example of how a business can go about exploiting the system's bottlenecks – ie using them in a way so as to maximise throughput. In practice, there may be lots of options open to the organisation such as the ones outlined in *The Goal*. In the context of an exam question, however, you are more likely to be asked to show how a bottleneck can be exploited by maximising throughput via the production of an optimum production plan. This requires an application of the simple principles of key factor analysis, otherwise known as limiting factor analysis or principal budget factor.

Limiting factor analysis and throughput accounting

Once an organisation has identified its bottleneck resource, as demonstrated in Step 1 above, it then has to decide how to get the most out of that resource. Given that most businesses are producing more than one type of product (or supplying more than one type of service), this means that part of the exploitation step involves working out what the optimum production plan is, based on maximising throughput per unit of bottleneck resource.

In key factor analysis, the contribution per unit is first calculated for each product, then a contribution per unit of scarce resource is calculated by working out how much of the scarce resource each unit requires in its production. In a throughput accounting context, a very similar calculation is performed, but this time it is not contribution per unit of scarce resource which is calculated, but throughput return per unit of bottleneck resource.

Throughput is calculated as 'selling price less direct material cost.' This is different from the calculation of 'contribution', in which both labour costs and variable overheads are also deducted from selling price. It is an important distinction because the fundamental belief in throughput accounting is that all costs except direct materials costs are largely fixed – therefore, to work on the basis of maximising contribution is flawed because to do so is to take into account costs that cannot be controlled in the short term anyway. One cannot help but agree with this belief really since, in most businesses, it is simply not possible, for example, to hire workers on a daily basis and lay workers off if they are not busy. A workforce has to be employed within the business and available for work if there is work to do. You cannot refuse to pay a worker if he is forced to sit idle by a machine for a while.

Example 1 Beta Co produces 3 products, E, F and G all in the same factory, details of which are shown below:

	E	F	G
	$	$	$
Selling price per unit	120	110	130
Direct material cost per unit	60	70	85
Maximum demand (units)	30,000	25,000	40,000
Time required on the bottleneck resource (hours per unit)	5	4	3

There are 320,000 bottleneck hours available each month.

Required: Calculate the optimum product mix each month.

Solution: A few simple steps can be followed:

1. Calculate the throughput per unit for each product.
2. Calculate the throughput return per hour of bottleneck resource.
3. Rank the products in order of the priority in which they should be produced, starting with the product that generates the highest return per hour first.
4. Calculate the optimum production plan, allocating the bottleneck resource to each one in order, being sure not to exceed the maximum demand for any of the products.

It is worth noting here that you often see another step carried out between Steps 2 and 3 above. This is the calculation of the throughput accounting ratio for each product. Thus far, ratios have not been discussed, and while I am planning on mentioning them later, I have never seen the point of inserting this extra step in when working out the optimum production plan for products all made in the same factory. The ranking of the products using the return per factory hour will always produce the same ranking as that produced using the throughput accounting ratio, so it doesn't really matter whether you use the return or the ratio. This is because the cost per factory hour (the denominator of the throughput accounting ratio) will be the same for all the products.

	E	F	G
	$	$	$
Selling price per unit	120	110	130
Direct material cost per unit	60	70	85
Throughput per unit	60	40	45
Time required on the bottleneck resource (hours per unit)	5	4	3
Return per factory hour	$12	$10	$15
Ranking	2	3	1

It is worth noting that, before the time taken on the bottleneck resource was taken into account, product E appeared to be the most profitable because it generated the highest throughput per unit. However, applying the theory of constraints, the system's bottleneck must be exploited by using it to produce the products that maximise throughput per hour first (Step 2 of the five focusing steps). This means that product G should be produced in priority to E.

In practice, Step 3 will be followed by making sure that the optimum production plan is adhered to throughout the whole system, with no machine making more units than can be absorbed by the bottleneck, and sticking to the priorities decided.

When answering a question like this in an exam it is useful to draw up a small table, like the one shown below. This means that the marker can follow your logic and award all possible marks, even if you have made an error along the way.

Product	No. of units	Hrs per unit	Total hrs	Throughput/hr	Total throughput
G	40,000	3	120,000	$15	$1,800,000
E	30,000	5	$150,000	$12	$1,800,000
F	12,500	4	50,000	$10	$500,000
					$4,100,000

Each time you allocate time on the bottleneck resource to a product, you have to ask yourself how many hours you still have available. In this example, there were enough hours to produce the full quota for G and E. However, when you got to F, you could see that out of the 320,000 hours available, 270,000 had been used up (120,000 + 150,000), leaving only 50,000 hours spare.

Therefore, the number of units of F that could be produced was a balancing figure – 50,000 hours divided by the four hours each unit requires – ie 12,500 units.

The above example concentrates on Steps 2 and 3 of the five focusing steps. I now want to look at an example of the application of Steps 4 and 5. I have kept it simple by assuming that the organisation only makes one product, as it is the principle that is important here, rather than the numbers. The example also demonstrates once again how to identify the bottleneck resource (Step 1) and then shows how a bottleneck may be elevated, but will then be replaced by another. It also shows that it may not always be financially viable to elevate a bottleneck.

Example 2: Cat Co makes a product using three machines – X, Y and Z. The capacity of each machine is as follows:

Machine	X	Y	Z
Capacity per week	800	600	500

The demand for the product is 1,000 units per week. For every additional unit sold per week, net present value increases by $50,000. Cat Co is considering the following possible purchases (they are not mutually exclusive):

Purchase 1: Replace machine X with a newer model. This will increase capacity to 1,100 units per week and costs $6m.

Purchase 2: Invest in a second machine Y, increasing capacity by 550 units per week. The cost of this machine would be $6.8m.

Purchase 3: Upgrade machine Z at a cost of $7.5m, thereby increasing capacity to 1,050 units.

Required: Which is Cat Co's best course of action?

Solution: First, it is necessary to identify the system's bottleneck resource. Clearly, this is machine Z, which only has the capacity to produce 500 units per week. Purchase 3 is therefore the starting point when considering the logical choices that face Cat Co. It would never be logical to consider either Purchase 1 or 2 in isolation because of the fact that neither machines X nor machine Y is the starting bottleneck. Let's have a look at how the capacity of the business increases with the choices that are available to it.

Machine	X	Y	Z	Demand
Current capacity per week	800	600	500*	1,000
Buy Z	800	600*	1,050	1,000
Buy Z and Y	800*	1,150	1,050	1,000
Buy Z, Y and X	1,100	1,150	1,050	1,000

* = bottleneck resource

From the table above, it can be seen that once a bottleneck is elevated, it is then replaced by another bottleneck until ultimately market demand constrains production. At this point, it would be necessary to look beyond production and consider how to increase market demand by, for example, increasing advertising of the product.

In order to make a decision as to which of the machines should be purchased, if any, the financial viability of the three options should be calculated.

Buy Z

Additional sales units = 600 - 500 = 100 units

	$'000
Benefit (100 units x $50,000)	5,000
Cost	(7,500)
Net cost	(2,500)

Buy Z and Y

Additional sales units = 800 - 500 = 300 units

	$'000
Benefit (300 units x $50,000)	15,000
Cost ($7.5m + $6.8m)	(14,300)
Net benefit	700

Buy Z, Y and X

Additional sales units = 1,000 - 500 = 500 units

	$'000
Benefit (500 units x $50,000)	25,000
Cost ($7.5m + $6.8m + $6m)	(20,300)
Net benefit	4,700

The company should therefore invest in all three machines if it has enough cash to do so.

The example of Cat Co demonstrates the fact that, as one bottleneck is elevated, another one appears. It also shows that elevating a bottleneck is not always financially viable. If Cat Co was only able to afford machine Z, it would be better off making no investment at all because if Z alone is invested in, another bottleneck appears too quickly for the initial investment cost to be recouped.

Ratios

I want to finish off by briefly mentioning throughput ratios. There are three main ratios that are calculated: (1) return per factory hour, (2) cost per factory hour and (3) the throughput accounting ratio.

1. Return per factory hour = Throughput per unit / product time on bottleneck resource. As we saw in Example 1, the return per factory hour needs to be calculated for each product.

2. Cost per factory hour = Total factory costs / total time available on bottleneck resource. The 'total factory cost' is simply the 'operational expense' of the organisation referred to in the previous article. If the organisation was a service organisation, we would simply call it 'total operational expense' or something similar. The cost per factory hour is across the whole factory and therefore only needs to be calculated once.

3. Throughput accounting ratio (TPAR) = Return per factory hour/cost per factory hour. In any organisation, you would expect the throughput accounting ratio to be greater than 1. This means that the rate at which the organisation is generating cash from sales of this product is greater than the rate at which it is incurring costs. It follows on, then, that if the ratio is less than 1, this is not the case, and changes need to be made quickly.

Conclusion

At this point, I'm hopeful that you are now looking forward to reading *The Goal* as soon as possible and that you have a better understanding of the theory of constraints and throughput accounting, which you can put into practice by tackling some questions.

Written by a member of the Performance Management examining team

Questions

(1)
Which of the following statements about the theory of constraints is NOT true?
A It focuses on removing bottlenecks in production to improve throughput
B Non-bottleneck resources should not be operated at full capacity
C It can only be used in manufacturing organisations
D It aims to reduce delays in meeting customer orders

Answer: C

The theory of constraints can be used in any organisation where there is a sequence of steps that are followed – this could include service or manufacturing industries. All other statements are correct.

(2)

A company manufactures a product which requires four hours per unit of machine time. Machine time is a bottleneck resource as there are only 10 machines which are available for 12 hours per day, five days per week. The product has a selling price of $130 per unit, direct material costs of $50 per unit, labour costs of $40 per unit and factory overhead costs of $20 per unit. These costs are based on weekly production and sales of 150 units.

What is the throughput accounting ratio (to 2 decimal places)?

A 1·33
B 2·00
C 0·75
D 0·31

Answer: A

Return per factory hour = ($130 – $50) ÷ 4 hours = $20
Factory costs per hour = $20 + $40 ÷ 4 = $15
TAR = $20 ÷ $15 = 1·33

Chapter 7 Environmental Management Accounting

Executive Summary

Environmental management accounting is a subset of environmental accounting. It focuses on information required for decision making within the organisation, although much of the information it generates could also be used for external reporting.

The categories of costs would be

- Environmental prevention costs
- Environmental detection costs
- Environmental internal failure costs
- Environmental external failure costs

There are three main reasons why the management of environmental costs is becoming increasingly important in organisations

First, society as a whole has become more environmentally aware, with people becoming increasingly aware about the 'carbon footprint' and recycling taking place now in many countries.

Second, environmental costs are becoming huge for some companies, particularly those operating in highly industrialised sectors such as oil production.

Third, regulation is increasing worldwide at a rapid pace, with penalties for non-compliance also increasing accordingly.

Defining environmental costs

- conventional costs
- potentially hidden costs
- contingent costs
- image and relationship costs

Identifying environmental costs

Controlling environmental costs

- waste and effluent disposal
- water consumption
- energy
- transport and travel
- consumables and raw materials.

Accounting for environmental costs

Input/outflow analysis

Flow cost accounting

Activity-based costing

Lifecycle costing

A member of the Performance Management examining team provides students with an introduction to environmental management accounting

The two requirements of the Performance Management syllabus are as follows:

- discuss the issues businesses face in the management of environmental costs
- describe the different methods a business may use to account for its environmental costs.

You should note that the Performance Management syllabus examines 'environmental management accounting' rather than 'environmental accounting'. Environmental accounting is a broader term that encompasses the provision of environment-related information both externally and internally. It focuses on reports required for shareholders and other stakeholders, as well of the provision of management information. Environmental management accounting, on the other hand, is a subset of environmental accounting. It focuses on information required for decision making within the organisation, although much of the information it generates could also be used for external reporting.

The aim of this article is to give a general introduction on the area of environmental management accounting, followed by a discussion of the first of the two requirements listed above.

Many of you reading this article still won't be entirely clear on what environmental management accounting actually is. You will not be alone! There is no single textbook definition for it, although there are many long-winded, jargon ridden ones available. Before we get into the unavoidable jargon, the easiest way to approach it in the first place is to step back and ask ourselves what management accounting itself is. Management accounts give us an analysis of the performance of a business and are ideally prepared on a timely basis so that we get up-to-date management information. They break down each of our different business segments (in a larger business) in a high level of detail. This information is then used to assess how the business' historic performance has been and, moving forward, how it can be improved in the future.

Environmental management accounting is simply a specialised part of the management accounts that focuses on things such as the cost of energy and water and the disposal of waste and effluent. It is important to note at this point that the focus of environmental management accounting is not all on purely financial costs. It includes consideration of matters such as the costs vs benefits of buying from suppliers who are more environmentally aware, or the effect on the public image of the company from failure to comply with environmental regulations.

Environmental management accounting uses some standard accountancy techniques to identify, analyse, manage and hopefully reduce environmental costs in a way that provides mutual benefit to the company and the environment, although sometimes it is only possible to provide benefit to one of these parties.

Example: Activity-based costing may be used to ascertain more accurately the costs of washing towels at a gym. The energy used to power the washing machine is an environmental cost; the cost driver is 'washing'.

Once the costs have been identified and information accumulated on how many customers are using the gym, it may actually be established that some customers are using more than one towel on a single visit to the gym. The gym could drive forward change by informing customers that they need to pay for a second towel if they need one. Given that this approach will be seen as 'environmentally-friendly', most customers would not argue with its introduction. Nor would most of them want to pay for the cost of a second towel. The costs to be saved by the company from this new policy would include both the energy savings from having to run fewer washing machines all the time and the staff costs of those people collecting the towels and operating the machines. Presumably, since the towels are being washed less frequently, they will need to be replaced by new ones less often as well.

In addition to these savings to the company, however, are the all-important savings to the environment since less power and cotton (or whatever materials the towels are made from) is now being used, and the scarce resources of our planet are therefore being conserved. Lastly, the gym is also seen as an environmentally friendly organisation and this, in turn, may attract more customers and increase revenues. Just a little bit of management accounting (and common sense!) can achieve all these things. While I always like to minimise the use of jargon, in order to be fully versed on what environmental management accounting is really seen by the profession as encompassing today, it is necessary to consider a couple of the most widely accepted definitions of it.

In 1998, the International Federation of Accountants (IFAC) originally defined environmental management accounting as:

'The management of environmental and economic performance, through the development and implementation of appropriate environment-related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves lifecycle costing, full cost accounting, benefits assessment, and strategic planning for environmental management.'

Then, in 2001, The United Nations Division for Sustainable Development (UNDSD) emphasised their belief that environmental management accounting systems generate information for internal decision making rather than external decision making. This is in line with my statement at the beginning of this article that EMA is a subset of environmental accounting as a whole.

The UNDSD make what became a widely accepted distinction between two types of information: physical information and monetary information. Hence, they broadly defined EMA to be the identification, collection, analysis and use of two types of information for internal decision making:

- physical information on the use, flows and destinies of energy, water and materials (including wastes)

- monetary information on environment-related costs, earnings and savings.

This definition was then adopted by an international consensus group of over 30 nations and thus eventually adopted by IFAC in its 2005 international guidance document on 'environmental management accounting'.

To summarise then, for the purposes of clarifying the coverage of the Performance Management syllabus, my belief is that EMA is internally not externally focused and the Performance Management syllabus should, therefore, focus on information for internal decision making only. It should not be concerned with how environmental information is reported to stakeholders, although it could include consideration of how such information could be reported internally. For example, Hansen and Mendoza (1999) stated that environmental costs are incurred because of poor quality controls. Therefore, they advocate the use of a periodical environmental cost report that is produced in the format of a cost of quality report, with each category of cost being expressed as a percentage of sales revenues or operating costs so that comparisons can be made between different periods and/or organisations. The categories of costs would be as follows:

- Environmental prevention costs: the costs of activities undertaken to prevent the production of waste.
- Environmental detection costs: costs incurred to ensure that the organisation complies with regulations and voluntary standards.
- Environmental internal failure costs: costs incurred from performing activities that have produced contaminants and waste that have not been discharged into the environment.
- Environmental external failure costs: costs incurred on activities performed after discharging waste into the environment.

It is clear from the suggested format of this quality type report that Hansen and Mendoza's definition of 'environmental cost' is relatively narrow.

Managing environmental costs

There are three main reasons why the management of environmental costs is becoming increasingly important in organisations.

First, society as a whole has become more environmentally aware, with people becoming increasingly aware about the 'carbon footprint' and recycling taking place now in many countries. A 'carbon footprint' (as defined by the Carbon Trust) measures the total greenhouse gas emissions caused directly and indirectly by a person, organisation, event or product. Companies are finding that they can increase their appeal to customers by portraying themselves as environmentally responsible.

Second, environmental costs are becoming huge for some companies, particularly those operating in highly industrialised sectors such as oil production. In some cases, these costs

can amount to more than 20% of operating costs. Such significant costs need to be managed.

Third, regulation is increasing worldwide at a rapid pace, with penalties for non-compliance also increasing accordingly. In the largest ever seizure related to an environmental conviction in the UK, a plant hire firm, John Craxford Plant Hire Ltd, had to not only pay £85,000 in costs and fines but also got £1.2m of its assets seized. This was because it had illegally buried waste and also breached its waste and pollution permits. And it's not just the companies that need to worry. Officers of the company and even junior employees could find themselves facing criminal prosecution for knowingly breaching environmental regulations.

But the management of environmental costs can be a difficult process. This is because first, just as EMA is difficult to define, so too are the actual costs involved. Second, having defined them, some of the costs are difficult to separate out and identify. Third, the costs can need to be controlled but this can only be done if they have been correctly identified in the first place. Each of these issues is dealt with in turn below.

Defining environmental costs

Many organisations vary in their definition of environmental costs. It is neither possible nor desirable to consider all of the great range of definitions adopted. A useful cost categorisation, however, is that provided by the US Environmental Protection Agency in 1998. They stated that the definition of environmental costs depended on how an organisation intended on using the information. They made a distinction between four types of costs:

- conventional costs: raw material and energy costs having environmental relevance
- potentially hidden costs: costs captured by accounting systems but then losing their identity in 'general overheads'
- contingent costs: costs to be incurred at a future date – for example, clean up costs
- image and relationship costs: costs that, by their nature, are intangible, for example, the costs of preparing environmental reports.

The UNDSD, on the other hand, described environmental costs as comprising of:

- costs incurred to protect the environment – for example, measures taken to prevent pollution, and
- costs of wasted material, capital and labour, ie inefficiencies in the production process.

Neither of these definitions contradict each other; they just look at the costs from slightly different angles. As a Performance Management student, you should be aware that definitions of environmental costs vary greatly, with some being very narrow and some being far wider.

Identifying environmental costs

Much of the information that is needed to prepare environmental management accounts could actually be found in a business' general ledger. A close review of it should reveal the costs of materials, utilities and waste disposal, at the least. The main problem is, however, that most of the costs will have to be found within the category of 'general overheads' if they are to be accurately identified. Identifying them could be a lengthy process, particularly in a large organisation. The fact that environmental costs are often 'hidden' in this way makes it difficult for management to identify opportunities to cut environmental costs and yet it is crucial that they do so in a world which is becoming increasingly regulated and where scarce resources are becoming scarcer.

It is equally important to allocate environmental costs to the processes or products which give rise to them. Only by doing this can an organisation make well-informed business decisions. For example, a pharmaceutical company may be deciding whether to continue with the production of one of its drugs. In order to incorporate environmental aspects into its decision, it needs to know exactly how many products are input into the process compared to its outputs; how much waste is created during the process; how much labour and fuel is used in making the drug; how much packaging the drug uses and what percentage of that is recyclable etc. Only by identifying these costs and allocating them to the product can an informed decision be made about the environmental effects of continued production.

In 2003, the UNDSD identified four management accounting techniques for the identification and allocation of environmental costs: input/outflow analysis, flow cost accounting, activity based costing and lifecycle costing. These are referred to later under 'different methods of accounting for environmental costs'.

Controlling environmental costs

It is only after environmental costs have been defined, identified and allocated that a business can begin the task of trying to control them.

As we have already discussed, environmental costs will vary greatly from business to business and, to be honest, a lot of the environmental costs that a large, highly industrialised business will incur will be difficult for the average person to understand, since that person won't have a detailed knowledge of the industry concerned.

I will therefore use some basic examples of easy-to-understand environmental costs when considering how an organisation may go about controlling such costs. Let us consider an organisation whose main environmental costs are as follows:

- waste and effluent disposal
- water consumption
- energy

- transport and travel
- consumables and raw materials.

Each of these costs is considered in turn below.

Waste There are lots of environmental costs associated with waste. For example, the costs of unused raw materials and disposal; taxes for landfill; fines for compliance failures such as pollution. It is possible to identify how much material is wasted in production by using the 'mass balance' approach, whereby the weight of materials bought is compared to the product yield. From this process, potential cost savings may be identified. In addition to these monetary costs to the organisation, waste has environmental costs in terms of lost land resources (because waste has been buried) and the generation of greenhouse gases in the form of methane.

Water You have probably never thought about it but businesses actually pay for water twice – first, to buy it and second, to dispose of it. If savings are to be made in terms of reduced water bills, it is important for organisations to identify where water is used and how consumption can be decreased.

Energy Often, energy costs can be reduced significantly at very little cost. Environmental management accounts may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings.

Transport and travel Again, environmental management accounting can often help to identify savings in terms of business travel and transport of goods and materials. At a simple level, a business can invest in more fuel-efficient vehicles, for example.

Consumables and raw materials These costs are usually easy to identify and discussions with senior managers may help to identify where savings can be made. For example, toner cartridges for printers could be refilled rather than replaced.

This should produce a saving both in terms of the financial cost for the organisation and a waste saving for the environment (toner cartridges are difficult to dispose of and less waste is created this way).

Accounting for environmental costs

In the context of Performance Management, when the syllabus requires you to describe the different methods of accounting for environmental costs, it aims to cover two areas:

- Internal reporting of environmental costs, which has already been discussed in the introduction.
- Management accounting techniques for the identification and allocation of environmental costs: the most appropriate ones for the Performance Management syllabus are those

identified by the UNDSD, namely input/outflow analysis, flow cost accounting, activity-based costing and lifecycle costing.

Input/outflow analysis

This technique records material inflows and balances this with outflows on the basis that, what comes in, must go out. So, if 100kg of materials have been bought and only 80kg of materials have been produced, for example, then the 20kg difference must be accounted for in some way. It may be, for example, that 10% of it has been sold as scrap and 90% of it is waste. By accounting for outputs in this way, both in terms of physical quantities and, at the end of the process, in monetary terms too, businesses are forced to focus on environmental costs.

Flow cost accounting

This technique uses not only material flows but also the organisational structure. It makes material flows transparent by looking at the physical quantities involved, their costs and their value. It divides the material flows into three categories: material, system and delivery and disposal. The values and costs of each of these three flows are then calculated. The aim of flow cost accounting is to reduce the quantity of materials which, as well as having a positive effect on the environment, should have a positive effect on a business' total costs in the long run.

Activity-based costing

ABC allocates internal costs to cost centres and cost drivers on the basis of the activities that give rise to the costs. In an environmental accounting context, it distinguishes between environment-related costs, which can be attributed to joint cost centres, and environment-driven costs, which tend to be hidden on general overheads.

Lifecycle costing

Within the context of environmental accounting, lifecycle costing is a technique which requires the full environmental consequences, and, therefore, costs, arising from production of a product to be taken account across its whole lifecycle, literally 'from cradle to grave'.

Summary

I hope you now have a clearer idea about exactly what environmental management accounting is and why it's important. While I have tried to give some simple, practical examples and explanations, a certain amount of jargon is unavoidable in this subject area. Enjoy your further reading.

Written by a member of the Performance Management examining team

Questions

The following are types of management accounting techniques:
(1) Flow cost accounting
(2) Input/output analysis
(3) Life-cycle costing
(4) Activity based costing

Which of the above techniques could be used by a company to account for its environmental costs?
A 1 only
B 1 and 2 only
C 1, 2 and 3 only
D All of the above

Answer: D

These are all techniques that can be used in environmental management accounting.

Chapter 8 Relevant Costs

Executive Summary

This article looks at relevant costs, which can be defined as any cost relevant to a decision.

'Relevant costs' can be defined as any cost relevant to a decision. A matter is relevant if there is a change in cash flow that is *caused* by the decision.

The change in cash flow can be:

- additional amounts that must be paid
- a decrease in amounts that must be paid
- additional revenue that will be earned
- a decrease in revenue that will be earned.

A change in the cash flow can be identified by asking if the amounts that would appear on the company's bank statement are affected by the decision, whether increased or decreased. Banks record cash so this test is reliable.

1. Sunk costs (past costs) or committed costs are not relevant

Sunk, or past, costs are monies already spent or money that is already contracted to be spent. A decision on whether or not a new endeavour is started will have no effect on this cash flow, so sunk costs cannot be relevant.

For example, money that has been spent on market research for a new product or planning a new factory is already spent and isn't coming back to the company, irrespective of whether the product is approved for manufacture or the factory is built.

Committed costs are costs that would be incurred in the future but they cannot be avoided because the company has already committed to them through another decision which has been made.

For example, if a company has two year lease for piece of machinery, that cost will not be relevant to a decision on whether to use that machinery on a new project which will last for the next month.

2. Re-apportionment of existing fixed costs are not relevant

Irrespective of what treatment is used in the company's management accounts to split up costs, if the total costs remain the same, there is no cash flow effect caused by the decision.

Note that additional fixed costs caused by a decision are relevant. So, if you were evaluating the viability of a new production facility, then the rent of a building specially leased for the new facility is relevant.

3. Depreciation and book values (notional costs) are not relevant

Depreciation is not a cash flow and is dependent on past purchases and somewhat arbitrary depreciation rates. By the same argument, book values are not relevant as these are simply the result of historical costs (or historical revaluation) and depreciation.

4. Increases or decreases in cash flows caused by a project are relevant

So, if an old product is discontinued three years early to make room for a new product, the revenue and cost decreases relating to the old product are relevant, as are the revenue and cost increases on the new. The cost effects relate to both changes in variable costs and changes in total fixed costs.

5. Revenues forgone (given up) because of a decision are relevant

If a company decides to keep an asset for use in the manufacture of a new product rather than selling it, then its cash flow is affected by the decision to keep the asset, as it will now not benefit from the sale of the asset. This effect is known as an opportunity cost, which is the value of a benefit foregone when one course of action is chosen in preference to another. In this case, the company has given up its opportunity to have a cash inflow from the asset sale.

Types of decision
We will now look at some typical examples where you have to decide which costs are relevant to decision-making. We suggest that you try each example yourself before you look at each solution. In all examples we ignore the time value of money.

Always think: what future cash flows are changed by the decision? Changes in future cash flows reliably indicate which amounts are relevant to the decision.

Example 1: Relevant cost of materials
A company is considering making a new product which requires several types of raw material:

	Units in inventory	**Units required**	**Additional information**
Material A	Nil	40	Current purchase price is $7/unit.
Material B	100 purchased for $10/unit	150	Current purchase price is $14/unit. The material has no use in the company other than

			for the project under consideration. Units in inventory can be sold for $12/unit.
Material C	50 purchased for $20/unit	120	Current purchase price is $22/unit. The material is regularly used in current manufacturing operations.

What is the relevant cost of the materials required for manufacture of the new product?

Solution:
Taking each material in turn:

Material A – As there is no inventory, all 40 units required will have to be bought in at $7 per unit. This is a clear cash outflow caused by the decision to make the new product. Therefore, the relevant cost of Material A for the new product is (40 units x $7) = $280.

Material B - The 100 units of the material already in inventory has no other use in the company, so if it is not used on the new product, then the assumption is that it would be sold for $12/unit. If the new product is made, this sale won't happen and the cash flow is affected. The original purchase price of $10 is a sunk cost and so is not relevant. In addition, another 50 units are needed for the new product and these will need to be bought in at a price of $14/unit.

The total relevant cost for Material B is:

100 units x $12 (lost sale proceeds) =	$1,200
50 units x $14 (current purchase price) =	$700
	$1,900

Material C – This material is regularly used in the company, so if the 50 units in inventory are diverted to the new product then this will mean that inventory will need to be replenished. In order to do this, Material C purchases for existing products will be accelerated by 50 units. The current purchase price of $22 will be used to determine the relevant cost of Material C as this will be the value of each unit purchased. The original

purchase price of $20 is a sunk cost and so is not relevant. Therefore the relevant cost of Material C for the new product is (120 units x $22) = $2,640.

Example 2: Relevant cost of labour

A company has a new project which requires the following three types of labour:

	Hours required	**Additional information**
Unskilled	12,000	Paid at $8 per hour and existing staff are fully utilised. The company will hire new staff to meet this additional demand.
Semi-skilled	2,000	Paid at $12 per hour. These employees are difficult to recruit and the company retains a number of permanently employed staff, even if there is no work to do. There is currently 800 hours of idle time available and any additional hours would be fulfilled by temporary staff that would be paid at $14/hour.
Skilled	8,000	Paid at $15 per hour. There is a severe shortage of employees with these skills and the only way that this labour can be provided for the new project would be for the company to move employees away from making Product X. A unit of Product X takes 4 hours to make and makes a contribution of $24/unit.

What is the relevant cost of the labour hours required for the new project?

Solution:

Taking each type of labour in turn:

Unskilled – 12,000 hours are required for the project and the company is prepared to hire more staff to meet this need. The incremental cash outflow of this decision is (12,000 hours x $8) = $96,000.

Semi-skilled - Of the 2,000 hours needed, 800 are already available and already being paid. There is no incremental cost of using these spare hours on the new project. However, the remaining 1,200 hours are still required and will need to be fulfilled by hiring temporary workers. Therefore, there is an extra wage cost of (1,200 hours x $14) = $16,800.

Skilled: Determining the relevant cost of labour if it is diverted from existing activities is tricky and is often done incorrectly. If this is the case, then the relevant cost is the variable cost of the labour plus the contribution foregone from not being able to use the labour for its existing purpose.

The temptation is to see that the same number of skilled employees are paid before and after being moved to the new project and therefore the opportunity cost of contribution foregone from diverting hours away from the existing production of Product X is the **only** relevant cost ($24/4 hours = $6 per hour). This is incorrect.

Say, for example, that 4 hours of labour were simply removed by 'sacking' an employee for four hours, one less unit of Product X could be made. Using the contribution foregone figure of $24 is the net effect of losing the revenue from that unit ***and*** also saving the material, labour and the variable costs. In this situation however, the labour is simply being redeployed so $24 understates the effect of this, as the labour costs are not saved.

Therefore, the relevant cost of skilled labour is:

8,000 hours x $15 (current labour cost per hour) =	$120,000
8,000 hours x $6 (lost contribution per hour diverted from making Product X) =	$48,000
	$168,000

Example 3: Relevant cost of machinery
Some years ago, a company bought a piece of machinery for $300,000. The net book value of the machine is currently $50,000. The company could spend $100,000 on updating the machine and the products subsequently made on it could generate a contribution of $150,000. The machine would be depreciated at $25,000 per annum. Alternatively, if the machine is not updated, the company could sell it now for $75,000.

On a relevant cost basis, should the company update and use the machine or sell it now?

Solution:
Immediately we can say that the $300,000 purchase cost is a sunk cost and the $50,000 book value and $25,000 depreciation charge are not cash flows and so are not relevant.

If the investment in the machinery is made, then the following cash flow changes are triggered:

- Machine update cost: $100,000
- Contribution from products: $150,000

- Opportunity cost: $75,000

Therefore, the relevant cost is:

Update cost =	$100,000
Add contribution =	$150,000
Less sales proceeds foregone =	$75,000
Net cash outflow	$25,000

As the relevant cost is a net cash outflow, the machine should be sold rather than retained, updated and used.

Example 4: Relevant cost of machinery
A business rents a factory for $60,000 per annum. Only half of the floor space is currently used and the company is considering installing a new machine in the unused part. The machine would cost $2.1m, be depreciated over 10 years at $200,000 per annum and then be sold for $100,000. The company would insure the new machine against damage for $5,000 per annum.

What are the relevant costs of the new machine purchase?

Solution:
Rent – this is not a relevant cost. Irrespective of how the company might use the floor space in the factory to generate a return, there is no change in cash flow relating to the rent as a result of the new machine.

Cost of machine - this is a relevant cost as $2.1m has to be paid out.

Depreciation – this is not a relevant cost as it is not a cash flow.

Sale proceeds – this is a relevant cost as it is a cash inflow which will occur in 10 years as a result of the decision to invest.

Annual insurance cost – this is a relevant cost as this is an additional fixed cost caused by the decision to invest.

These costs will have to be compared to the contribution that can be earned by the new machine to determine if the overall investment in the asset is financially viable.

The effects shown in Examples 1 – 4, above, are often found in questions where you are to determine whether or not a company should go ahead with a new project/investment/product, or if you are asked to calculate the minimum price a company should charge a customer for a piece of work.

Example 5: Further processing decision
A company buys a chemical for $12,000, which it breaks down into two components:

Component	Sales value ($)	Allocated costs ($)
A	7,000	6,000
B	4,000	6,000

Component A can be converted into Product A if $6,000 is spent on further processing. Product A would sell for $12,000.

Component B can be converted into Product B if $8,000 is spent on further processing. Product B would sell for $15,000.

What processing decision should the company make in order to maximise profits?

Solution:
As the initial chemical is split into both components, it is not possible to make one component without the other, therefore if the company were to make only the components, the costs and revenues of both components will need to be recognised:

Incremental revenue (sales of both components) =	$11,000

Incremental costs (cost of the chemical) =	$12,000
Net loss	($1,000)

This is not worthwhile as incremental costs exceed incremental revenues.

Next we should consider whether the components should be further processed into the products.

Further processing Component A to Product A incurs incremental costs of $6,000 and incremental revenues of $5,000 ($12,000 - $7,000). It is not worthwhile to do this, as the extra costs are greater than the extra revenue.

Further processing Component B to Product B incurs incremental costs of $8,000 and incremental revenues of $11,000 ($15,000 – $4,000). It is worthwhile to do this, as the extra revenue is greater than the extra costs.

The production plan is therefore:

	$	$
Component A revenue		7,000
Component B revenue		15,000
Total revenue		**22,000**
Chemical cost	12,000	
Further processing of Component B	8,000	
Total cost		**20,000**

Contribution		**2,000**

Example 6: Shut down decision

A company has two production lines and its management accounts show the following:

	Production Line A		**Production Line B**	
	$m	**$m**	**$m**	**$m**
Revenue		28		30
Marginal costs	12	-	20	-
Fixed costs	10		14	
Total cost		**22**		**34**
Profit/loss	-	**6**		**(4)**

The total fixed costs of $24m have been apportioned to each production line on the basis of the floor space occupied by each line in the factory.

The company is concerned about the loss that is reported by Production Line B and is considering closing down that line. Closing down either production line would save 25% of the total fixed costs.

Should the company close down Production Line B?

Solution:

The incremental cash flows of closing down Production Line B are:

Revenue lost =	$30m

Marginal costs saved = $20m

Fixed costs saved ($24m x 25%) = $6m

Therefore, the closure of Production Line B is not a good idea as the revenue lost is greater than the value of the costs saved.

What about closing down Production Line A?

The incremental cash flows of this decision would be:

Revenue lost = $28m

Marginal costs saved = $12m

Fixed costs saved ($24m x 25%) = $6m

The closure of Production Line A would also result in the revenue lost being greater than the value of the costs saved, so this isn't a good idea either.

Really, the heart of the matter is the misleading effect of the relatively arbitrary apportionment of the fixed costs. A more useful presentation of the figures for decision-making would be:

	Production Line A	**Production Line B**	**Total**
	$m	**$m**	**$m**

Revenue	28	30	58
Marginal costs	12	20	32
Contribution	**16**	**10**	**26**
Fixed costs			24
Profit/loss			**2**

Note that the $2m total profit is the same as the profit of $6m from Production Line A and the loss of $4m from Production Line B as shown in the table at the start of this example.

If either production line were closed down, fixed costs saved are 25% x $24m = $6m, however the contribution lost from the products (and contribution looks at cash flows caused by production) would be either $16m or $10m, which exceed the cash saved on the fixed costs.

Example 7: Make or buy decision
A company makes a product which requires two sequential operations (Operation 1 and Operation 2) on the same machine. The machine is fully utilised. Material costs $12 per unit.

Instead of carrying out Operation 1, the company could buy in components, for $15 per unit. This would allow production to be increased because the machine has to deal with only Operation 2.

Operation 1 takes 0.25 hours of machine time and Operation 2 takes 0.5 hours of machine time. Labour and variable overheads are incurred at a rate of $16/machine hour and the finished products sell for $30 per unit.

Should the company make the entire product internally or buy in the components and complete them in Operation 2?

Solution:
Some care is needed here to ensure all incremental cash flows caused by the decision are taken into account.

Machine running costs – the machine is already fully utilised on Operations 1 and 2 and will remain fully utilised, but only on Operation 2. Therefore, the machine running costs will not change, so are not relevant to the decision.

Material - if the buy-in option is accepted, the material cost increases from $12 to $15 per unit.

Production volume – this can increase by 50% because currently each item takes 0.5 hours in Operation 2, but 0.25 hours per unit will be released by Operation 1 which now will not be needed.

Assuming output is 1,000 units, the following would occur (ignoring labour and variable overheads which we know to be constant):

Increase in revenue (50% extra could be produced) = 500 additional units x $30 =	$15,000
Increase in costs (material/buy-in costs only) = (1,500 x $15) – (1,000 x $12) =	$10,500

Therefore, it is worth buying in as incremental revenue exceeds incremental costs.

Chapter 9 Cost Volume Profit Analysis

Executive Summary

Cost-volume-profit analysis looks primarily at the effects of differing levels of activity on the financial results of a business

One of the most important decisions that need to be made before any business even starts is 'how much do we need to sell in order to break-even?' By 'break-even' we mean simply covering all our costs without making a profit.

Methods for calculating the break-even point

(1) The equation method

A little bit of simple maths can help us answer numerous different cost volume-profit questions.

(2) The contribution margin method

This second approach uses a little bit of algebra to rewrite our equation above, concentrating on the use of the 'contribution margin'.

(3) The graphical method

With the graphical method, the total costs and total revenue lines are plotted on a graph; the point where the total cost and revenue lines intersect is the break-even point.

Ascertaining the sales volume required to achieve a target profit

Margin of safety

The margin of safety indicates by how much sales can decrease before a loss occurs – ie it is the excess of budgeted revenues over break-even revenues.

Contribution to sales ratio

It is often useful in single product situations, and essential in multi product situations, to ascertain how much each $ sold actually contributes towards the fixed costs. This calculation is known as the contribution to sales or C/S ratio.

Limitations of cost-volume profit analysis

Cost-volume-profit analysis looks primarily at the effects of differing levels of activity on the financial results of a business

In any business, or, indeed, in life in general, hindsight is a beautiful thing. If only we could look into a crystal ball and find out exactly how many customers were going to buy our product, we would be able to make perfect business decisions and maximise profits.

Take a restaurant, for example. If the owners knew exactly how many customers would come in each evening and the number and type of meals that they would order, they could ensure that staffing levels were exactly accurate and no waste occurred in the kitchen. The reality is, of course, that decisions such as staffing and food purchases have to be made on the basis of estimates, with these estimates being based on past experience.

While management accounting information can't really help much with the crystal ball, it can be of use in providing the answers to questions about the consequences of different courses of action. One of the most important decisions that need to be made before any business even starts is 'how much do we need to sell in order to break-even?' By 'break-even' we mean simply covering all our costs without making a profit.

This type of analysis is known as 'cost-volume-profit analysis' (CVP analysis) and the purpose of this article is to cover some of the straight forward calculations and graphs required for this part of the Performance Management syllabus, while also considering the assumptions which underlie any such analysis.

The objective of CVP analysis

CVP analysis looks primarily at the effects of differing levels of activity on the financial results of a business. The reason for the particular focus on sales volume is because, in the short-run, sales price, and the cost of materials and labour, are usually known with a degree of accuracy. Sales volume, however, is not usually so predictable and therefore, in the short-run, profitability often hinges upon it. For example, Company A may know that the sales price for product X in a particular year is going to be in the region of $50 and its variable costs are approximately $30.

It can, therefore, say with some degree of certainty that the contribution per unit (sales price less variable costs) is $20. Company A may also have fixed costs of $200,000 per annum, which again, are fairly easy to predict. However, when we ask the question, 'Will the company make a profit in that year?' the answer is 'We don't know'. We don't know because we don't know the sales volume for the year. However, we can work out how many sales the business needs to achieve in order to make a profit and this is where CVP analysis begins.

Methods for calculating the break-even point

The break-even point is when total revenues and total costs are equal, that is, there is no

profit but also no loss made. There are three methods for ascertaining this break-even point:

(1) The equation method

A little bit of simple maths can help us answer numerous different cost-volume-profit questions.

We know that total revenues are found by multiplying unit selling price (USP) by quantity sold (Q). Also, total costs are made up firstly of total fixed costs (FC) and secondly by variable costs (VC). Total variable costs are found by multiplying unit variable cost (UVC) by total quantity (Q). Any excess of total revenue over total costs will give rise to profit (P). By putting this information into a simple equation, we come up with a method of answering CVP type questions. This is done below continuing with the example of Company A above.

Total revenue – total variable costs – total fixed costs = Profit
(USP x Q) – (UVC x Q) – FC = P
(50Q) – (30Q) – 200,000 = P

Note: total fixed costs are used rather than unit fixed costs since unit fixed costs will vary depending on the level of output.

It would, therefore, be inappropriate to use a unit fixed cost since this would vary depending on output. Sales price and variable costs, on the other hand, are assumed to remain constant for all levels of output in the short-run, and, therefore, unit costs are appropriate.

Continuing with our equation, we now set P to zero in order to find out how many items we need to sell in order to make no profit, i.e. to break even:

(50Q) – (30Q) – 200,000 = 0
20Q – 200,000 = 0
20Q = 200,000
Q = 10,000 units.

The equation has given us our answer. If Company A sells less than 10,000 units, it will make a loss. If it sells exactly 10,000 units it will break-even, and if it sells more than 10,000 units, it will make a profit.

(2) The contribution margin method

This second approach uses a little bit of algebra to rewrite our equation above, concentrating on the use of the ‘contribution margin’. The contribution margin is equal to total revenue less total variable costs. Alternatively, the unit contribution margin (UCM) is the unit selling price (USP) less the unit variable cost (UVC). Hence, the formula from our mathematical method above is manipulated in the following way:

$$(USP \times Q) - (UVC \times Q) - FC = P$$
$$(USP - UVC) \times Q = FC + P$$
$$UCM \times Q = FC + P$$
$$Q = \frac{FC + P}{UCM}$$

So, if P = 0 (because we want to find the break-even point), then we would simply take our fixed costs and divide them by our unit contribution margin. We often see the unit contribution margin referred to as the 'contribution per unit'.

Applying this approach to Company A again:

UCM = 20, FC = 200,000 and P = 0.

$$Q = \frac{FC}{UCM}$$
$$Q = \frac{200{,}000}{20}$$

Therefore, Q = 10,000 units

The contribution margin method uses a little bit of algebra to rewrite our equation above, concentrating on the use of the 'contribution margin'.

(3) The graphical method

With the graphical method, the total costs and total revenue lines are plotted on a graph; $ is shown on the y axis and units are shown on the x axis. The point where the total cost and revenue lines intersect is the break-even point. The amount of profit or loss at different output levels is represented by the distance between the total cost and total revenue lines. **Figure 1** shows a typical break-even chart for Company A. The gap between the fixed costs and the total costs line represents variable costs.

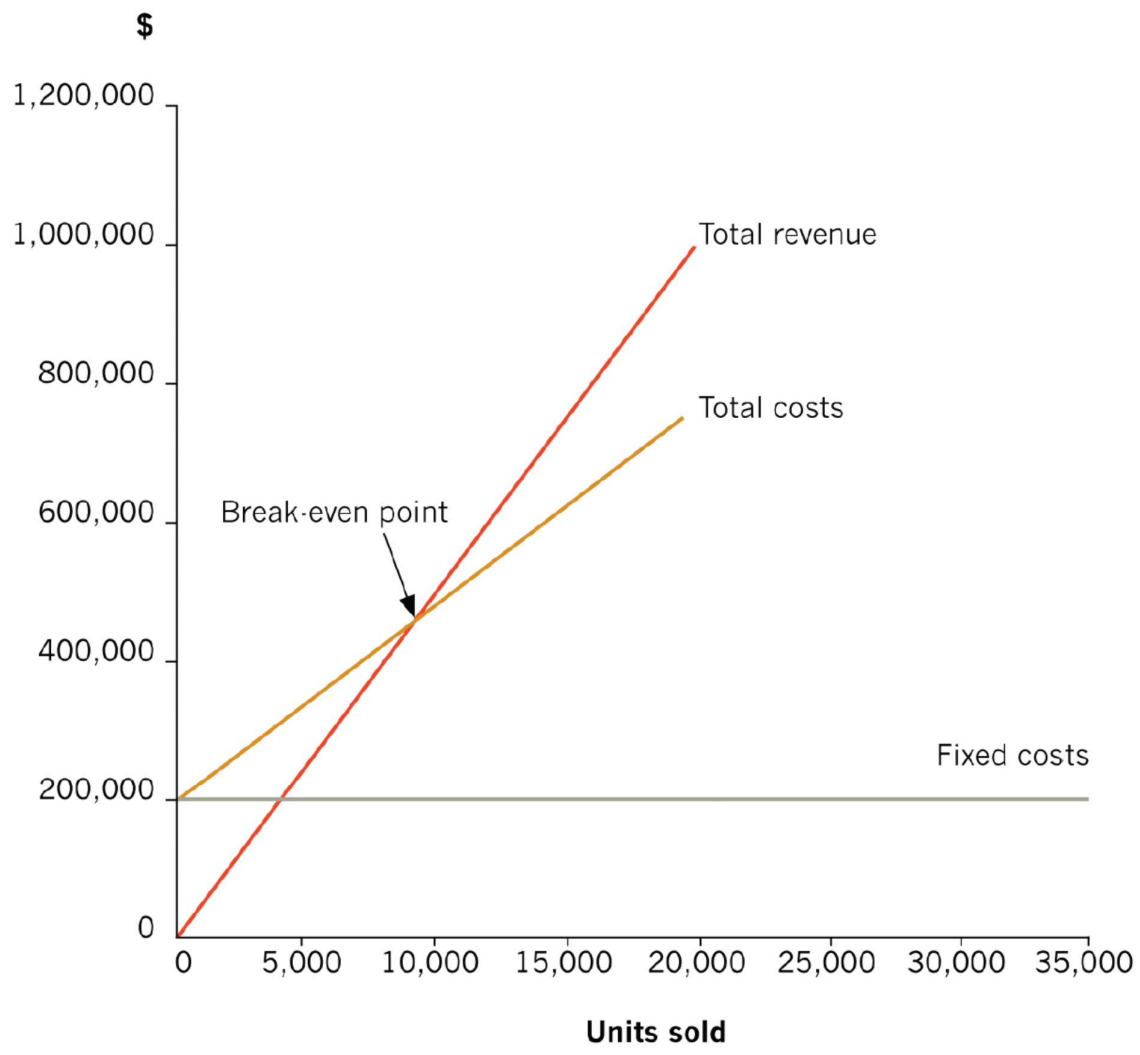


Figure 1

Alternatively, a contribution graph could be drawn. While this is not specifically covered by the Performance Management syllabus, it is still useful to see it. This is very similar to a break-even chart; the only difference being that instead of showing a fixed cost line, a variable cost line is shown instead.

Hence, it is the difference between the variable cost line and the total cost line that represents fixed costs. The advantage of this is that it emphasises contribution as it is represented by the gap between the total revenue and the variable cost lines. This is shown for Company A in **Figure 2**.

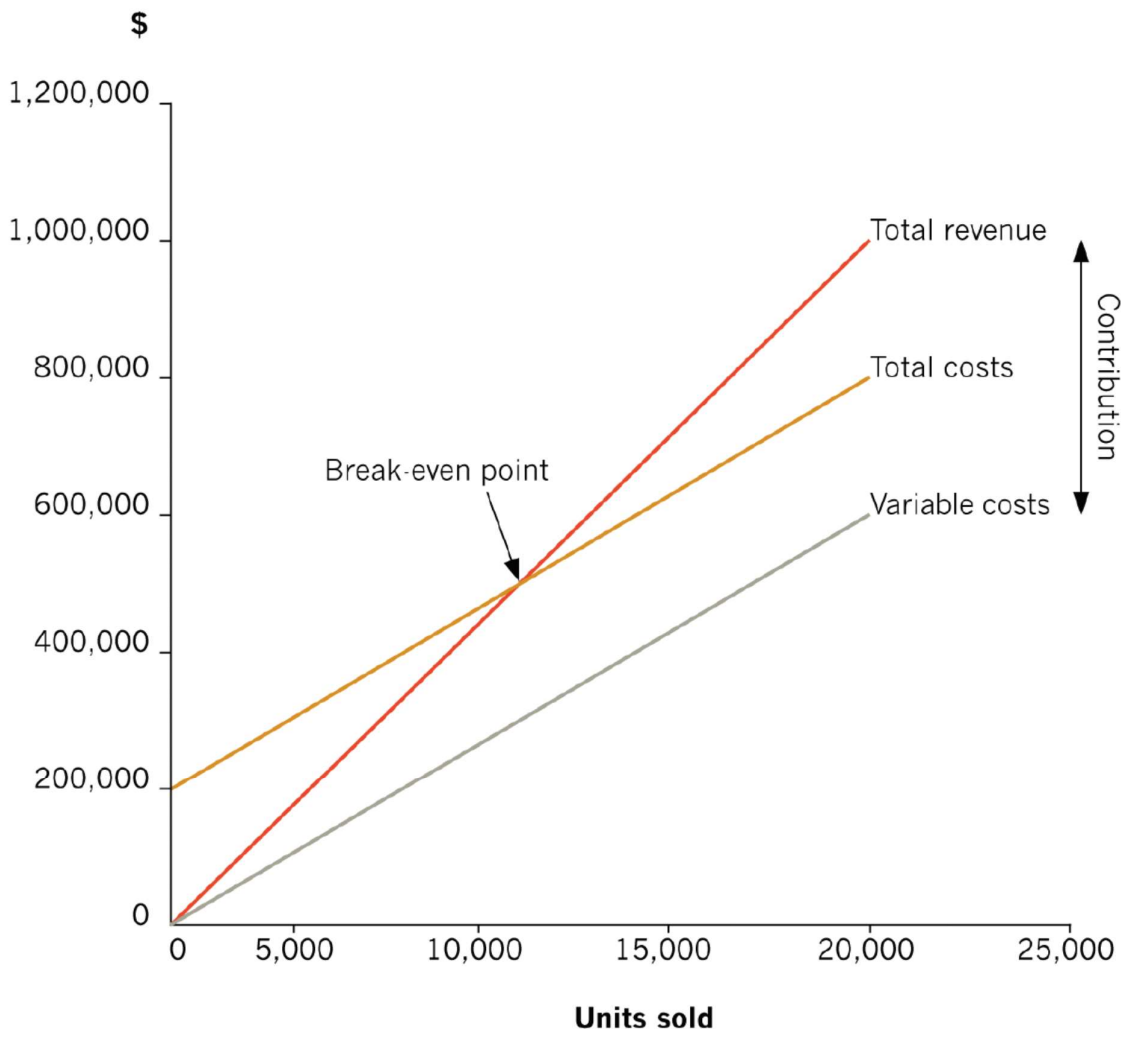


Figure 2

Finally, a profit–volume graph could be drawn, which emphasises the impact of volume changes on profit (**Figure 3**). This is key to the Performance Management syllabus and is discussed in more detail later in this article.

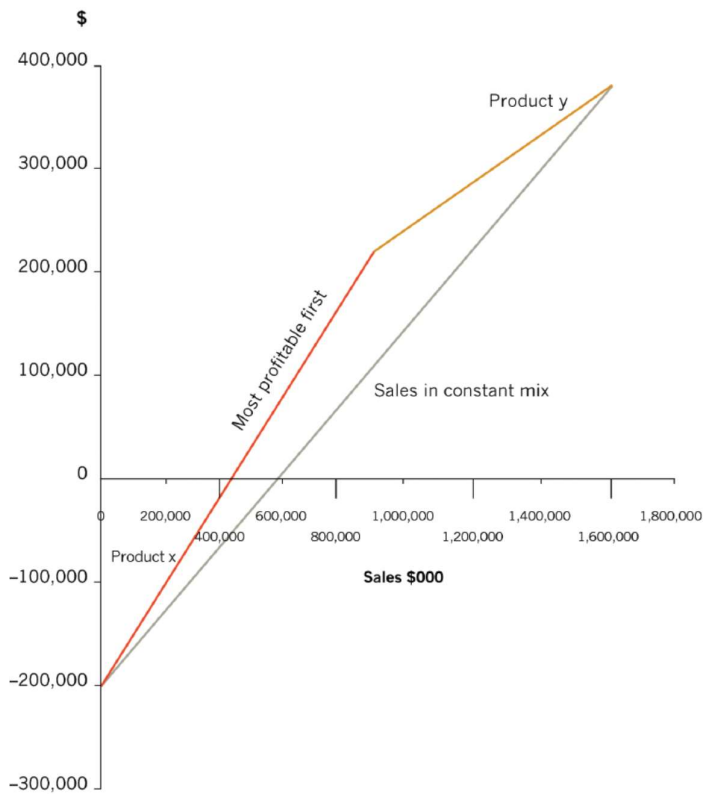


Figure 3

Ascertaining the sales volume required to achieve a target profit

As well as ascertaining the break-even point, there are other routine calculations that it is just as important to understand. For example, a business may want to know how many items it must sell in order to attain a target profit.

Example 1
Company A wants to achieve a target profit of $300,000. The sales volume necessary in order to achieve this profit can be ascertained using any of the three methods outlined above. If the equation method is used, the profit of $300,000 is put into the equation rather than the profit of $0:
(50Q) – (30Q) – 200,000 = 300,000
20Q – 200,000 = 300,000
20Q = 500,000
Q = 25,000 units.

Alternatively, the contribution method can be used:

UCM = 20, FC = 200,000 and P = 300,000.
Q = $\frac{FC + P}{}$

$$Q = \frac{UCM}{200,000 + 300,000}{20}$$

Therefore, Q = 25,000 units.

Finally, the answer can be read from the graph, although this method becomes clumsier than the previous two. The profit will be $300,000 where the gap between the total revenue and total cost line is $300,000, since the gap represents profit (after the break-even point) or loss (before the break-even point.)

A contribution graph shows the difference between the variable cost line and the total cost line that represents fixed costs. An advantage of this is that it emphasises contribution as it is represented by the gap between the total revenue and variable cost lines.

This is not a quick enough method to use in an exam so it is not recommended.

Margin of safety

The margin of safety indicates by how much sales can decrease before a loss occurs – ie it is the excess of budgeted revenues over break-even revenues. Using Company A as an example, let's assume that budgeted sales are 20,000 units. The margin of safety can be found, in units, as follows:

Budgeted sales – break-even sales = 20,000 – 10,000 = 10,000 units.

Alternatively, as is often the case, it may be calculated as a percentage:

(Budgeted sales – break-even sales)/budgeted sales

In Company A's case, it will be (10,000/20,000) x 100 = 50%.

Finally, it could be calculated in terms of $ sales revenue as follows:

(Budgeted sales – break-even sales) x selling price = 10,000 x $50 = $500,000.

Contribution to sales ratio

It is often useful in single product situations, and essential in multi-product situations, to ascertain how much each $ sold actually contributes towards the fixed costs. This calculation is known as the contribution to sales or C/S ratio. It is found in single product situations by either simply dividing the total contribution by the total sales revenue, or by dividing the unit contribution margin (otherwise known as contribution per unit) by the selling price:

For Company A: ($20/$50) = 0.4

In multi-product situations, a weighted average C/S ratio is calculated by using the formula:

Total contribution/total sales revenue

This weighted average C/S ratio can then be used to find CVP information such as break-even point, margin of safety, etc.

Example 2
As well as producing product X described above, Company A also begins producing product Y. The following information is available for both products:

	A	B	C	D	E
1					
2		X	Y		Company A
3		$/unit	$/unit		
4	Sales price	50	60		
5	Variable cost	30	45		
6	Contribution	20	15		
7					
8	Budgeted sales (units)	20,000	10,000		
9					
10	Total contribution	400,000	150,000		550,000
11	Total revenue	1,000,000	600,000		1,600,000
12	C/S ratio	0.40	0.25		0.34375

The weighted average C/S ratio of 0.34375 or 34.375% has been calculated by calculating the total contribution earned across both products and dividing that by the total revenue earned across both products.

The C/S ratio is useful in its own right as it tells us what percentage each $ of sales revenue contributes towards fixed costs; it is also invaluable in helping us to quickly calculate the break-even point in $ sales revenue, or the sales revenue required to generate a target profit. The break-even point in sales revenue can now be calculated this way for Company A:

Fixed costs/contribution to sales ratio = $200,000/0.34375 = $581,819 of sales revenue.

To achieve a target profit of $300,000:

(Fixed costs + required profit)/contribution to sales ratio = ($200,000 + $300,000)/0.34375 = $1,454,546.

Of course, such calculations provide only estimated information because they assume that products X and Y are sold in a constant mix of 2X to 1Y. In reality, this constant mix is unlikely to exist and, at times, more Y may be sold than X. Such changes in the mix throughout a period, even if the overall mix for the period is 2:1, will lead to the actual break-even point being different than anticipated. This point is touched upon again later in this article.

Contribution to sales ratio is often useful in single product situations, and essential in multi-product situations, to ascertain how much each $ sold actually contributes towards the fixed costs.

Multi-product profit–volume charts

When discussing graphical methods for establishing the break-even point, we considered break-even charts and contribution graphs. These could also be drawn for a company selling multiple products, such as Company A in our example.

The one type of graph that hasn't yet been discussed is a profit–volume graph. This is slightly different from the others in that it focuses purely on showing a profit/loss line and doesn't separately show the cost and revenue lines. In a multi-product environment, it is common to actually show two lines on the graph: one straight line, where a constant mix between the products is assumed; and one bow-shaped line, where it is assumed that the company sells its most profitable product first and then its next most profitable product, and so on.

In order to draw the graph, it is therefore necessary to work out the C/S ratio of each product being sold before ranking the products in order of profitability. It is easy here for Company A, since only two products are being produced, and so it is useful to draw a quick table as see on the spreadsheet below (prevents mistakes in the exam hall) in order to ascertain each of the points that need to be plotted on the graph in order to show the profit/loss lines.

The table should show the cumulative revenue, the contribution earned from each product and the cumulative profit/(loss). It is the cumulative figures which are needed to draw the graph.

	A	B	C	D
2		X	Y	Company A
3	C/S ratio	0.40	0.25	0.34375
4	Product ranking	1	2	
5				
6		Cumulative revenue	Contribution	Cumulative profit/(loss)
7	Fixed costs			($200,000)
8	X	1,000,000	400,000	200,000
9	Y	1,600,000	150,000	350,000
10				

The graph can then be drawn (**Figure 3**), showing cumulative sales on the x axis and cumulative profit/loss on the y axis. It can be observed from the graph that, when the company sells its most profitable product first (X) it breaks even earlier than when it sells products in a constant mix. The break-even point is the point where each line cuts the x axis.

Limitations of cost-volume profit analysis

- Cost-volume-profit analysis is invaluable in demonstrating the effect on an organisation that changes in volume (in particular), costs and selling prices, have on profit. However, its use is limited because it is based on the following assumptions: Either a single product is being sold or, if there are multiple products, these are sold in a constant mix. We have considered this above in Figure 3 and seen that if the constant mix assumption changes, so does the break-even point.
- All other variables, apart from volume, remain constant – ie volume is the only factor that causes revenues and costs to change. In reality, this assumption may not hold true as, for example, economies of scale may be achieved as volumes increase. Similarly, if there is a change in sales mix, revenues will change. Furthermore, it is often found that if sales volumes are to increase, sales price must fall. These are only a few reasons why the assumption may not hold true; there are many others.
- The total cost and total revenue functions are linear. This is only likely to hold a short-run, restricted level of activity.
- Costs can be divided into a component that is fixed and a component that is variable. In reality, some costs may be semi-fixed, such as telephone charges, whereby there may be a fixed monthly rental charge and a variable charge for calls made.
- Fixed costs remain constant over the 'relevant range' - levels in activity in which the business has experience and can therefore perform a degree of accurate analysis. It will either have operated at those activity levels before or studied them carefully so that it can, for example, make accurate predictions of fixed costs in that range.

- Profits are calculated on a variable cost basis or, if absorption costing is used, it is assumed that production volumes are equal to sales volumes.

Written by a member of the Performance Management examining team

Questions

(1)

Morava Co produces a product which has a variable cost of $28 and a selling price of $39. Budgeted sales and production volumes for the next month are 18,000 units. Budgeted fixed costs are $121,000 per month. If Morava wishes to generate a profit of $11,000, how many units must be sold?

A 1,000
B 10,000
C 11,000
D 12,000

Answer: D

For target profit questions, use the amended break even formula for sales volume required to achieve a target profit:
(Target profit + fixed cost) / Contribution per unit
= ($11,000 + $ 121,000) / ($39 - $28) = 12,000

Chapter 10 Linear Programming

Executive Summary

The first step in any linear programming problem is to define the variables and the objective function.

Defining variables

Let X = number of X to be produced Let Y = number of Y to be produced

Objective functions

Contribution = ($30 x units of X produced) + ($40 x units of Y produced), therefore: C = 30X + 40Y

Next step is to define constraints

Third step is plot a graph

Decision making is an important aspect of the Performance Management syllabus, and questions on this topic will be common. The range of possible questions is considerable, but this article will focus on only one: linear programming

The ideas presented in this article are based on a simple example. Suppose a profit-seeking firm has two constraints: labour, limited to 16,000 hours, and materials, limited to 15,000kg. The firm manufactures and sells two products, X and Y. To make X, the firm uses three kgs of material and four hours of labour, whereas to make Y, the firm uses five kgs of material and four hours of labour. The contribution per unit made by each product are $30 for X and $40 for Y. The cost of materials is normally $8 per kg, and the labour rate is $10 per hour.

The first step in any linear programming problem is to define the variables and the objective function. Defining the variables simply means stating what letter you are going to use to represent the products in the subsequent equations as follows;

Let X = number of X to be produced Let Y = number of Y to be produced

The objective function is essentially the contribution formula as the objective is to maximise contribution and therefore profit.

Contribution = ($30 x units of X produced) + ($40 x units of Y produced), therefore: $C = 30X + 40Y$

The next step is to define the constraints. In our example, the materials constraint will be $3X + 5Y \leq 15{,}000$, and the labour constraint will be $4X + 4Y \leq 16{,}000$.

Note: You should not forget the non-negativity constraint, if needed, of $X,Y \geq 0$.

In order to plot the graph you need to solve the constraints. This gives us the co-ordinates for the constraint lines on the graph.

Material: If X = 0, Y = 3,000 If Y = 0, X = 5,000

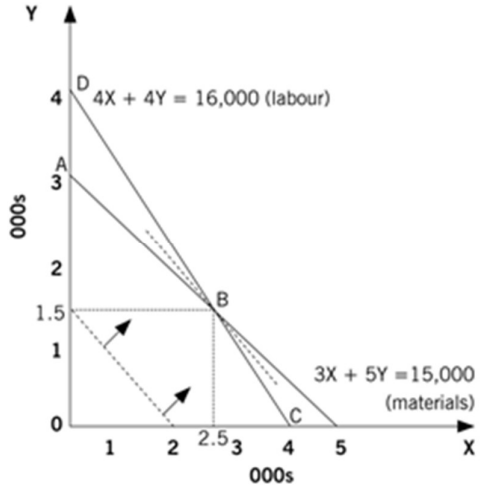
Labour: If X = 0, Y = 4,000 If Y = 0, X = 4,000

In order to be able to plot the objective function (contribution) line you need to insert a figure to represent contribution into the formula and solve in the same way as the constraints.

Note: Select a figure for contribution which is easily divisible by your two contribution per unit figures – for example:

Let C = $60,000 If X = 0, Y = 1,500 If Y = 0, X = 2,000

Figure 1: Optimal production plan



The area represented on the graph 0ABC is called the feasible region. Plotting the resulting graph will show that by pushing out the objective function to the furthest vertex in the feasible region which is along the gradient of the objective function, the optimal solution will be at point B – the intersection of materials and labour constraints. This is also the furthest vertex in the feasible region along the gradient of the objective function.

The optimal point is X = 2,500 and Y = 1,500, which generates $135,000 in contribution. Check this for yourself (Working 1). The ability to solve simultaneous equations is assumed in this article.

The point of this calculation is to provide management with a target production plan in order to maximise contribution and therefore profit. However, things can change and, in particular, constraints can relax or tighten. Management needs to know the financial implications of such changes. For example, if new materials are offered, how much should be paid for them? And how much should be bought? These dynamics are important.

Suppose the shadow price of materials is $5 per kg (this is verifiable by Working 2). The important point is, what does this mean? If management is offered more materials it should be prepared to pay no more than $5 per kg over the normal price. Paying less than $13 ($5 + $8) per kg to obtain more materials will make the firm better off financially. Paying more than $13 per kg would render it worse off in terms of contribution gained. Management needs to understand this.

There may, of course, be a good reason to buy ‘expensive’ extra materials (those costing more than $13 per kg). It might enable the business to satisfy the demands of an important customer who might, in turn, buy more products later. The firm might have to meet a contractual obligation, and so paying ‘too much’ for more materials might be justifiable if it will prevent a penalty on the contract. The cost of this is rarely included in shadow price calculations. Equally, it might be that ‘cheap’ material, priced at under $13 per kg, is not

attractive. Quality is a factor, as is reliability of supply. Accountants should recognise that 'price' is not everything.

How many materials to buy?

Students need to realise that as you buy more materials, then that constraint relaxes and so its line on the graph moves outwards and away from the origin. Eventually, the materials line will be totally outside the labour line on the graph and the point at which this happens is the point at which the business will cease to find buying more materials attractive (point D on the graph). Labour would then become the only constraint.

We need to find out how many materials are needed at point D on the graph, the point at which 4,000 units of Y are produced. To make 4,000 units of Y we need 20,000kg of materials. Consequently, the maximum amount of extra material required is 5,000kg (20,000 – 15,000).

Note: Although interpretation is important at this level, there will still be marks available for the basic calculations.

Workings

Working 1:

The optimal point is at point B, which is at the intersection of:
3X + 5Y = 15,000, and
4X + 4Y = 16,000

Multiplying the first equation by four and the second by three we get:
12X + 20Y = 60,000
12X + 12Y = 48,000

The difference in the two equations is:
8Y = 12,000, or Y = 1,500

Substituting Y = 1,500 in any of the above equations will give us the X value:
3X + 5 (1,500) = 15,000
3X = 7,500
X = 2,500

The contribution gained is (2,500 x 30) + (1,500 x 40) = $135,000

Working 2: Shadow price of materials
To find this we relax the material constraint by 1kg and resolve as follows:

3X + 5Y = 15,001 and
4X + 4Y = 16,000

Again, multiplying by four for the first equation and by three for the second produces:

12X + 20Y = 60,004
12X + 12Y = 48,000
8Y = 12,004
Y = 1,500.5

Substituting Y = 1,500.5 in any of the above equations will give us X:

3X + 5 (1,500.5) = 15,001
3X = 7,498.5
X = 2,499.5

The new level of contribution is: (2,499.5 x 30) + (1,500.5 x 40) = $135,005

The increase in contribution from the original optimal is the shadow price:
135,005 – 135,000 = $5 per kg.

Written by a member of the Performance Management examining team

Chapter 11 Decision Trees

Executive Summary

A **decision tree** is a diagrammatic representation of a problem and on it we show all possible courses of action that we can take in a particular situation and all possible outcomes for each possible course of action.

There are two stages to making decisions using decision trees.

1. The first stage is the construction stage
2. The second stage is the evaluation and recommendation stage

When a decision tree is evaluated, the evaluation starts on the right-hand side of the page and moves across to the left – ie in the opposite direction to when the tree was drawn. The steps to be followed are as follows:

1. Label all of the decision and outcome points

2. Then, moving from right to left across the page, at each outcome point, calculate the expected value of the cash flows by applying the probabilities to the cash flows.

Joint probabilities have been by combining the probabilities of success and failure (0.7 and 0.3) with the probabilities of high, medium and low profits.

The value of perfect and imperfect information

Perfect information is said to be available when a 100% accurate prediction can be made about the future. Imperfect information, on the other hand, is not 100% accurate but provides more knowledge than no information.

This article provides a step-by-step approach to decision trees, using a simple example to guide you through.

There is no universal set of symbols used when drawing a decision tree but the most common ones that we tend to come across in accountancy education are squares (□), which are used to represent 'decisions' and circles (○), which are used to represent 'outcomes.' Therefore, I shall use these symbols in this article and in any suggested solutions for exam questions where decision trees are examined.

Decision trees and multi-stage decision problems

A decision tree is a diagrammatic representation of a problem and on it we show all possible courses of action that we can take in a particular situation and all possible outcomes for each possible course of action. It is particularly useful where there are a series of decisions to be made and/or several outcomes arising at each stage of the decision-making process. For example, we may be deciding whether to expand our business or not. The decision may be dependent on more than one uncertain variable.

For example, sales may be uncertain but costs may be uncertain too. The value of some variables may also be dependent on the value of other variables too: maybe if sales are 100,000 units, costs are $4 per unit, but if sales are 120,000 units costs fall to $3.80 per unit. Many outcomes may therefore be possible and some outcomes may also be dependent on previous outcomes. Decision trees provide a useful method of breaking down a complex problem into smaller, more manageable pieces.

There are two stages to making decisions using decision trees. The first stage is the construction stage, where the decision tree is drawn and all of the probabilities and financial outcome values are put on the tree. The principles of relevant costing are applied throughout – ie only relevant costs and revenues are considered. The second stage is the evaluation and recommendation stage. Here, the decision is 'rolled back' by calculating all the expected values at each of the outcome points and using these to make decisions while working back across the decision tree. A course of action is then recommended for management.

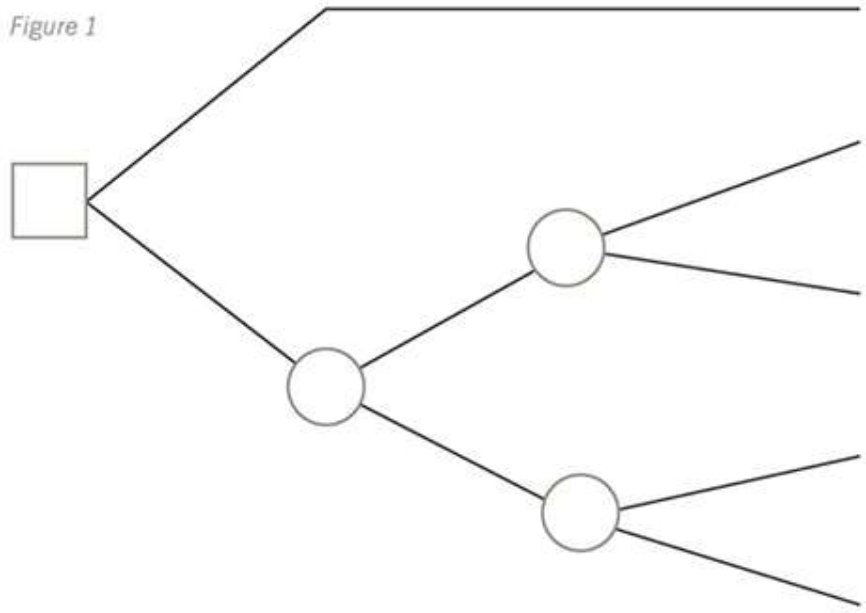
Constructing the tree

A decision tree is always drawn starting on the left hand side of the page and moving across to the right. Above, I have mentioned decisions and outcomes. Decision points represent the alternative courses of action that are available to you. These are within your control – it is your choice. You either take one course of action or you take another. Outcomes, on the other hand, are not within your control. They are dependent on the external environment – for example, customers, suppliers and the economy. Both decision points and outcome points on a decision tree are always followed by branches. If there are two possible courses of action – for example, there will be two branches coming off the

decision point; and if there are two possible outcomes – for example, one good and one bad, there will be two branches coming off the outcome point. It makes sense to say that, given that decision trees facilitate the evaluation of different courses of actions, all decision trees must start with a decision, as represented by a □.

A simple decision tree is shown below. It can be seen from the tree that there are two choices available to the decision maker since there are two branches coming off the decision point. The outcome for one of these choices, shown by the top branch off the decision point, is clearly known with certainty, since there is no outcome point further along this top branch. The lower branch, however, has an outcome point on it, showing that there are two possible outcomes if this choice is made. Then, since each of the subsidiary branches off this outcome point also has a further outcome point on with two branches coming off it, there are clearly two more sets of outcomes for each of these initial outcomes. It could be, for example, that the first two outcomes were showing different income levels if some kind of investment is undertaken and the second set of outcomes are different sets of possible variable costs for each different income level.

Figure 1



Once the basic tree has been drawn, like above, the probabilities and expected values must be written on it. Remember, the probabilities shown on the branches coming off the outcome points must always add up to 100%, otherwise there must be an outcome missing or a mistake with the numbers being used. As well as showing the probabilities on the branches of the tree, the relevant cash inflows/outflows must also be written on there too. This is shown in the example later on in the article.

Once the decision tree has been drawn, the decision must then be evaluated.

Evaluating the decision

When a decision tree is evaluated, the evaluation starts on the right-hand side of the page and moves across to the left – ie in the opposite direction to when the tree was drawn. The steps to be followed are as follows:

1. Label all of the decision and outcome points – ie all the squares and circles. Start with the ones closest to the right-hand side of the page, labelling the top and then the bottom ones, and then move left again to the next closest ones.
2. Then, moving from right to left across the page, at each outcome point, calculate the expected value of the cash flows by applying the probabilities to the cash flows. If there is room, write these expected values on the tree next to the relevant outcome point, although be sure to show all of your workings for them clearly beneath the tree too.

Finally, the recommendation is made to management, based on the option that gives the highest expected value.

It is worth remembering that using expected values as the basis for making decisions is not without its limitations. Expected values give us a long run average of the outcome that would be expected if a decision was to be repeated many times. So, if we are in fact making a one-off decision, the actual outcome may not be very close to the expected value calculated and the technique is therefore not very accurate. Also, estimating accurate probabilities is difficult because the exact situation that is being considered may not well have arisen before.

The expected value criterion for decision making is useful where the attitude of the investor is risk neutral. They are neither a risk seeker nor a risk avoider. If the decision maker's attitude to risk is not known, it difficult to say whether the expected value criterion is a good one to use. It may in fact be more useful to see what the worst-case scenario and best-case scenario results would be too, in order to assist decision making.

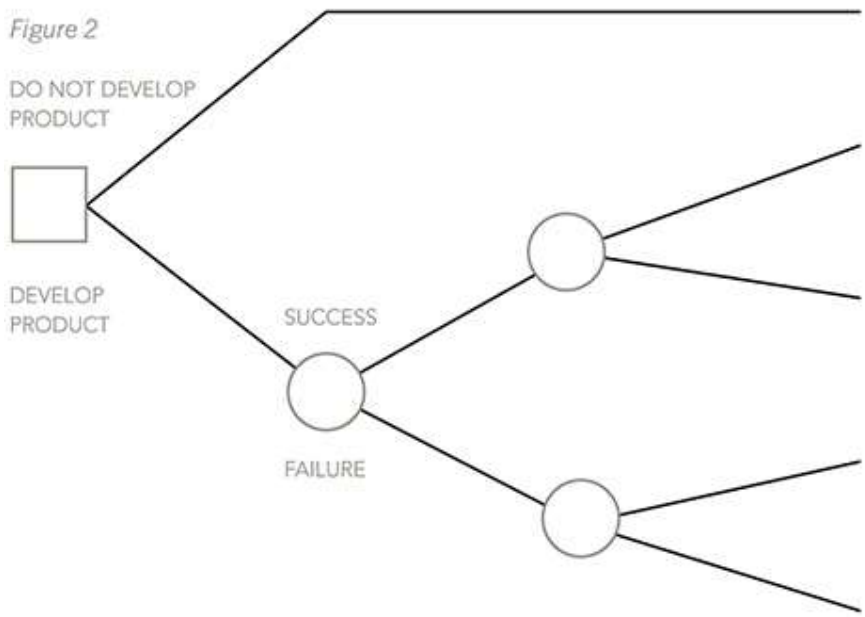
Let me now take you through a simple decision tree example. For the purposes of simplicity, you should assume that all of the figures given are stated in net present value terms.

Example 1: A company is deciding whether to develop and launch a new product. Research and development costs are expected to be $400,000 and there is a 70% chance that the product launch will be successful, and a 30% chance that it will fail. If it is successful, the levels of expected profits and the probability of each occurring have been estimated as follows, depending on whether the product's popularity is high, medium or low:

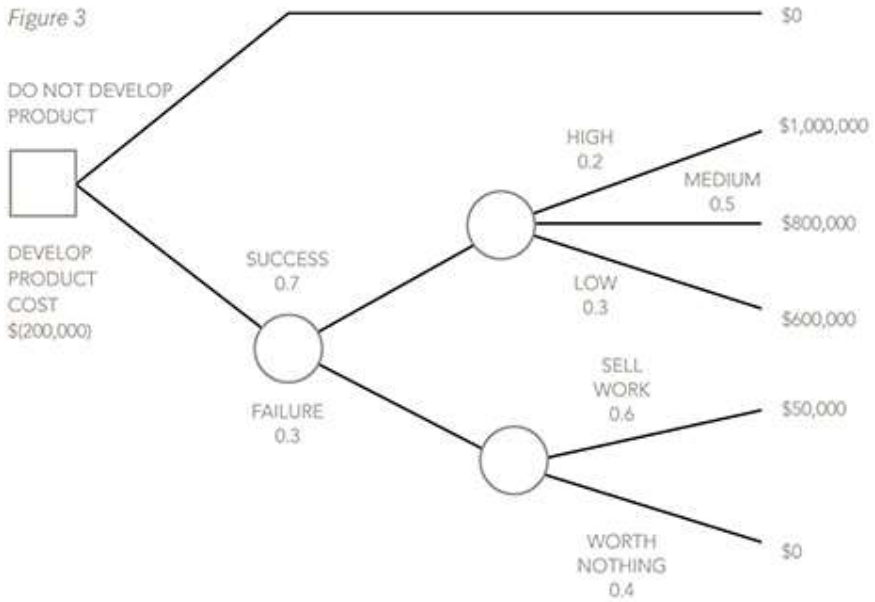
	Probability	
High	0.2	$500,000 per annum for two years
Medium	0.5	$400,000 per annum for two years
Low	0.3	$300,000 per annum for two years

If it is a failure, there is a 0.6 probability that the research and development work can be sold for $50,000 and a 0.4 probability that it will be worth nothing at all.

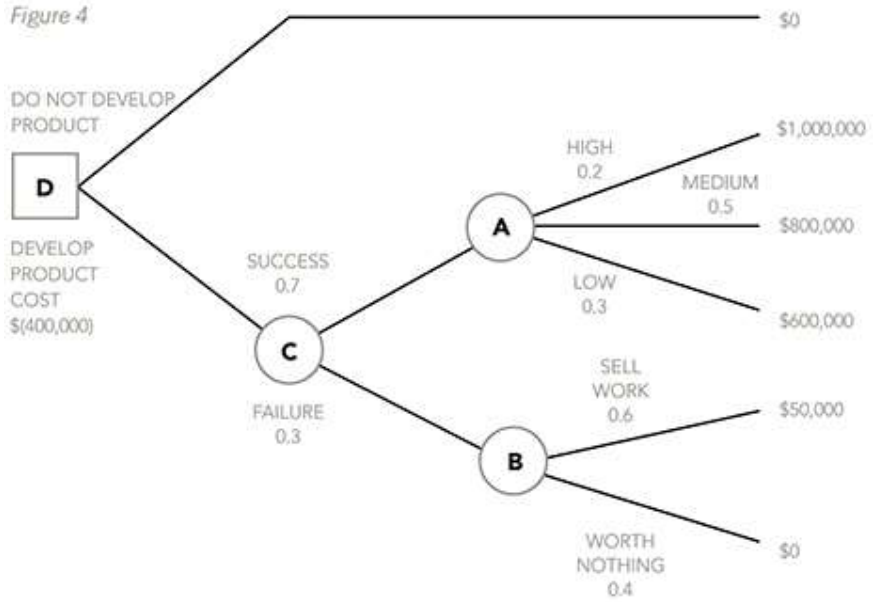
The basic structure of the decision tree must be drawn, as shown below:



Next, the probabilities and the profit figures must be put on, not forgetting that the profits from a successful launch last for two years, so they must be doubled.



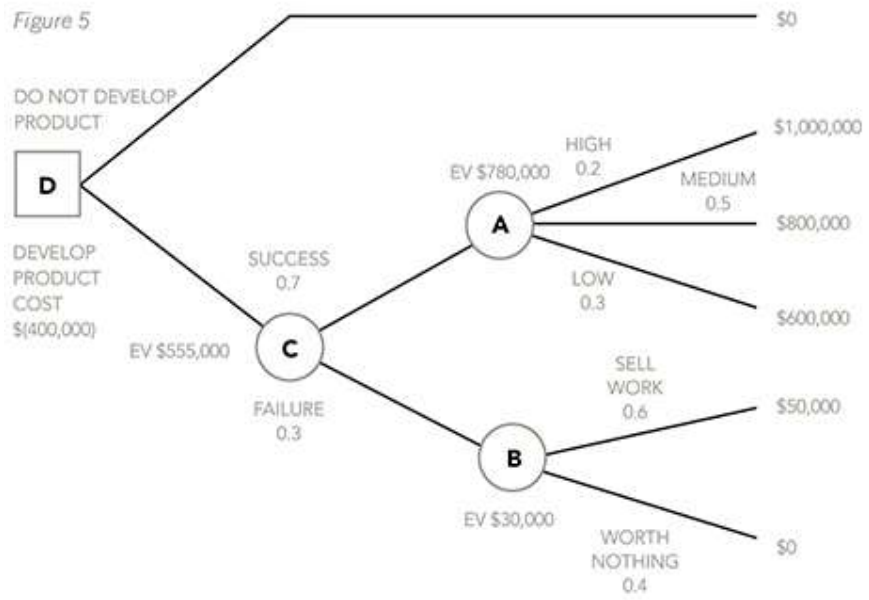
Now, the decision points and outcome points must be labelled, starting from the right-hand side and moving across the page to the left.



Now, calculate the expected values at each of the outcome points, by applying the probabilities to the profit figures. An expected value will be calculated for outcome point A and another one will be calculated for outcome point B. Once these have been calculated, a third expected value will need to be calculated at outcome point C. This will be done by applying the probabilities for the two branches off C to the two expected values that have already been calculated for A and B.

EV at A = (0.2 x $1,000,000) + (0.5 x $800,000) + (0.3 x $600,000) = $780,000. EV at B = (0.6 x $50,000) + (0.4 x $0) = $30,000. EV at C = (0.7 x $780,000) + (0.3 x $30,000) = $555,000

These expected values can then be put on the tree if there is enough room.



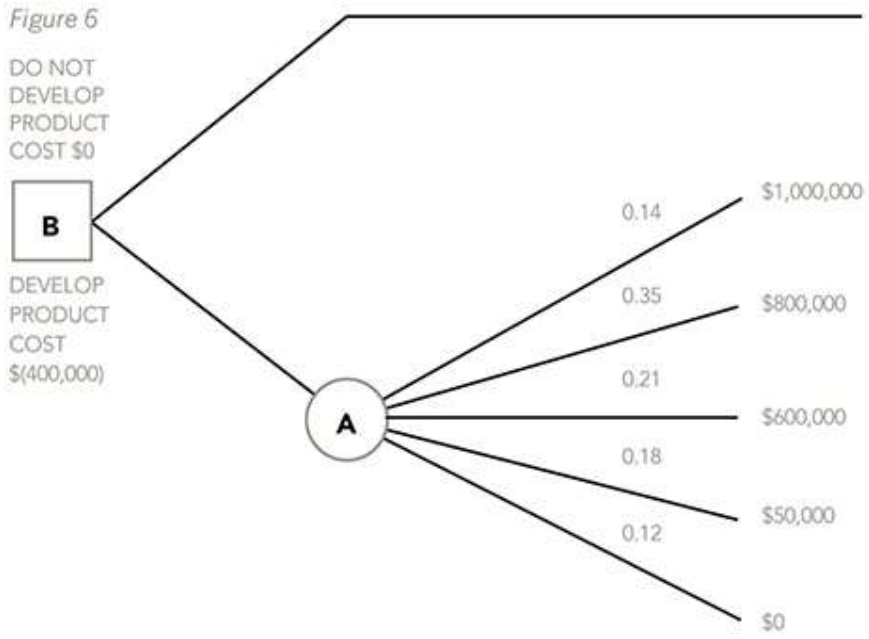
Once this has been done, the decision maker can then move left again to decision point D. At D, the decision maker compares the value of the top branch of the decision tree (which, given there were no outcome points, had a certain outcome and therefore needs no probabilities to be applied to it) to the expected value of the bottom branch. Costs will then need to be deducted. So, at decision point D compare the EV of not developing the product, which is $0, with the EV of developing the product once the costs of $400,000 have been taken off – ie $155,000.

Finally, the recommendation can be made to management. Develop the product because the expected value of the profits is $155,000.

Often, there is more than one way that a decision tree could be drawn. In my example, there are actually five outcomes if the product is developed:

1. It will succeed and generate high profits of $1,000,000.
2. It will succeed and generate medium profits of $800,000.
3. It will succeed and generate low profits of $600,000.
4. It will fail but the work will be sold generating a profit of $50,000.
5. It will fail and generate no profits at all.

Therefore, instead of decision point C having only two branches on it, and each of those branches in turn having a further outcome point with two branches on, we could have drawn the tree as follows:



You can see that the probabilities on the branches of the tree coming off outcome point A are now new. This is because they are *joint probabilities* and they have been by combining the probabilities of success and failure (0.7 and 0.3) with the probabilities of high, medium and low profits (0.2, 0.5, 0.3). The joint probabilities are found easily simply by multiplying the two variables together each time:

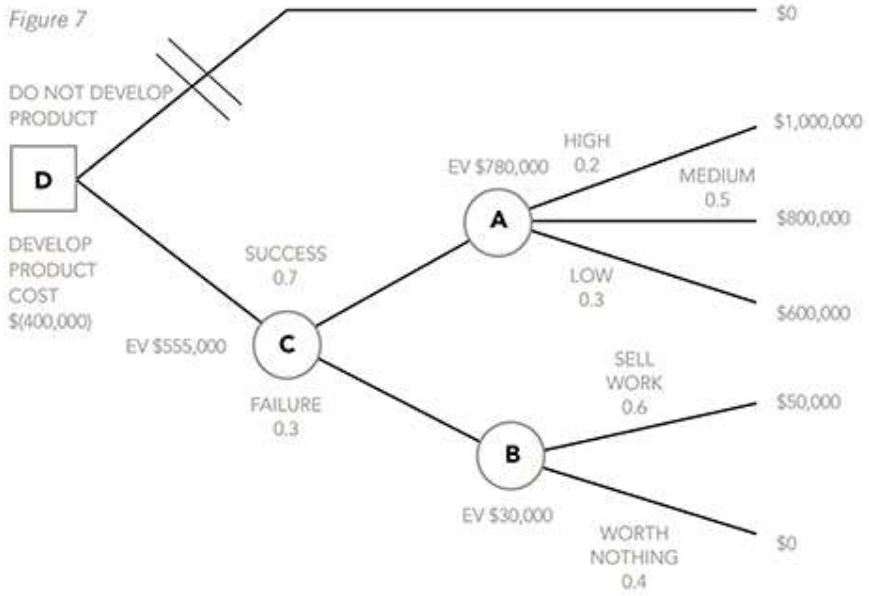
Success and high profits: 0.7 x 0.2 = 0.14 Success and medium profits: 0.7 x 0.5 = 0.35 Success and low profits: 0.7 x 0.3 = 0.21 Fail and sell works: 0.3 x 0.6 = 0.18 Fail and don't sell work: 0.3 x 0.4 = 0.12

All of the joint probabilities above must, of course, add up to 1, otherwise a mistake has been made.

Whether you use my initial method, which I always think is far easier to follow, or the second method, your outcome will always be the same.

The decision tree example above is quite a simple one but the principles to be grasped from it apply equally to a more complex decision resulting in a tree with far more decision points, outcomes and branches on.

Finally, I always cross off the branch or branches after a decision point that show the alternative I haven't chosen, in this case being the 'do not develop product' branch. Not everyone does it this way but I think it makes the tree easy to follow. Remember, outcomes are not within your control, so branches off outcome points are never crossed off. I have shown this crossing off of the branches below on my original, preferred tree:



The value of perfect and imperfect information

Perfect information is said to be available when a 100% accurate prediction can be made about the future. Imperfect information, on the other hand, is not 100% accurate but provides more knowledge than no information. Imperfect information is far more difficult to calculate and you would only ever need to do this in the exam if the numbers were extremely straightforward to start with. In this article, we are only going to deal with perfect information in any detail. This is because the calculations involved in calculating the value of imperfect information from my example are more complex than Performance Management syllabus would require you to calculate.

Perfect information

The value of perfect information is the difference between the expected value of profit with perfect information and the expected value of profit without perfect information. So, in our example, let us say that an agency can provide information on whether the launch is going to be successful and produce high, medium or low profits or whether it is simply going to fail. The expected value with perfect information can be calculated using a small table. At this point, it is useful to have calculated the joint probabilities mentioned in the second decision tree method above because the answer can then be shown like this.

Success or failure and demand level	Joint probability	Profit less cost	Proceed?	
Success and high	0.14	$600,000	Yes	$84,000
Success and medium	0.35	$400,000	Yes	$140,000
Success and low	0.21	$200,000	Yes	$42,000
Fail and sell	0.18	($350,000)	No	0
Fail and don't sell	0.12	($400,000)	No	0
				$266,000

However, it could also be done by using the probabilities from our original tree in the table below and then multiplying them by the success and failure probabilities of 0.7 and 0.3:

Demand level	Probability	Profit less development cost	Proceed?	
High	0.20	$600,000	Yes	$120,000
Medium	0.50	$400,000	Yes	$200,000
Low	0.30	$200,000	Yes	$60,000
				$380,000

EV of success with perfect information = 0.7 x $380,000 = $266,000

Demand level	Probability	Profit less development cost	Proceed?	
Fail and sell	0.60	($350,000)	No	0
Fail and don't sell	0.40	($400,000)	No	0
				$0

EV of failure with perfect information = 0.3 x $0 = $0. Therefore, total expected value with perfect information = $266,000.

Whichever method is used, the value of the information can then be calculated by deducting the expected value of the decision without perfect information from the expected value of the decision with perfect information – ie $266,000 – $155,000 = $111,000. This would represent the absolute maximum that should be paid to obtain such information.

Imperfect information

In reality, information obtained is rarely perfect and is merely likely to give us more information about the likelihood of different outcomes rather than perfect information about them. However, the numbers involved in calculating the values of imperfect information are rather complex and at this level, any numerical question would need to be relatively simple. You should refer to the recommended text for a worked example on the value of imperfect information. It is suffice here to say that the value of imperfect information will always be less than the value of perfect information unless both are zero. This would occur when the additional information would not change the decision. Note that the principles that are applied for calculating the value of imperfect information are the same as those applied for calculating the value of perfect information.

Written by a member of the Performance Management examining team

Questions

Tree Co is considering employing a sales manager. Market research has shown that a good sales manager can increase profit by 30%, an average one by 20% and a poor one by 10%. Experience has shown that the company has attracted a good sales manager 35% of the time, an average one 45% of the time and a poor one 20% of the time. The company's normal profits are $180,000 per annum and the sales manager's salary would be $40,000 per annum.

Based on the expected value criterion, which of the following represents the correct advice which Tree Co should be given?

A Do not employ a sales manager as profits would be expected to fall by $1,300

B Employ a sales manager as profits will increase by $38,700

C Employ a sales manager as profits are expected to increase by $100

D Do not employ a sales manager as profits are expected to fall by $39,900

Answer: A

New profit figures before salary paid:

- Good manager: $180,000 x 1·3 = $234,000
- Average manager: $180,000 x 1·2 = $216,000
- Poor: $180,000 x 1·1 = $198,000

EV of profits = (0·35 x $234,000) + (0·45 x $216,000) + (0·2 x $198,000) = $81,900 + $97,200 + $39,600 = $218,700

Deduct salary cost and EV with manager = $178,700

Therefore do not employ manager as profits will fall by $1,300.

Chapter 12 The Risks of Uncertainty

Executive Summary

The basic definition of risk is that the final outcome of a decision, such as an investment, may differ from that which was expected when the decision was taken.

Risk is when the probabilities of the possible outcomes are; uncertainty is where the randomness of outcomes cannot be expressed in terms of specific probabilities.

Probability refers to the likelihood or chance that a certain event will occur, with potential values ranging from 0 to 1

An independent event occurs when the outcome does not depend on the outcome of a previous event.

A conditional event, the outcomes of two or more events are related – ie the outcome of the second event depends on the outcome of the first event.

The expected value of the outcome can be calculated simply by multiplying the value associated with each potential outcome by its probability.

The coefficient of variation is calculated simply by dividing the standard deviation by the expected return (or mean):

Coefficient of variation = standard deviation / expected return

This article introduces the concepts of risk and uncertainty together with the use of probabilities in calculating both expected values and measures of dispersion.

Clearly, risk permeates most aspects of corporate decision-making (and life in general), and few can predict with any precision what the future holds in store.

Risk can take myriad forms – ranging from the specific risks faced by individual companies (such as financial risk, or the risk of a strike among the workforce), through the current risks faced by particular industry sectors (such as banking, car manufacturing, or construction), to more general economic risks resulting from interest rate or currency fluctuations, and, ultimately, the looming risk of recession. Risk often has negative connotations, in terms of potential loss, but the potential for greater than expected returns also often exists.

Clearly, risk is almost always a major variable in real-world corporate decision-making, and managers ignore its vagaries at their peril. Similarly, trainee accountants require an ability to identify the presence of risk and incorporate appropriate adjustments into the problem-solving and decision-making scenarios encountered in the exam hall. While it is unlikely that the precise probabilities and perfect information, which feature in exam questions can be transferred to real-world scenarios, a knowledge of the relevance and applicability of such concepts is necessary.

In this article, the concepts of risk and uncertainty will be introduced together with the use of probabilities in calculating both expected values and measures of dispersion. In addition, the attitude to risk of the decision-maker will be examined by considering various decision-making criteria, and the usefulness of decision trees will also be discussed.

The basic definition of risk is that the final outcome of a decision, such as an investment, may differ from that which was expected when the decision was taken. We tend to distinguish between risk and uncertainty in terms of the availability of probabilities. Risk is when the probabilities of the possible outcomes are known (such as when tossing a coin or throwing a dice); uncertainty is where the randomness of outcomes cannot be expressed in terms of specific probabilities. However, it has been suggested that in the real world, it is generally not possible to allocate probabilities to potential outcomes, and therefore the concept of risk is largely redundant. In the artificial scenarios of exam questions, potential outcomes and probabilities will generally be provided, therefore a knowledge of the basic concepts of probability and their use will be expected.

Probability

The term ‘probability’ refers to the likelihood or chance that a certain event will occur, with potential values ranging from 0 (the event will not occur) to 1 (the event will definitely occur). For example, the probability of a tail occurring when tossing a coin is 0.5, and the probability when rolling a dice that it will show a four is 1/6 (0.166). The total of all the probabilities from all the possible outcomes must equal 1 – ie some outcome must occur.

A real world example could be that of a company forecasting potential future sales from the introduction of a new product in year one (**Table 1**).

Table 1: Probability of new product sales

Sales	$500,000	$700,000	$1,000,000	$1,250,000	$1,500,000
Probability	0.1	0.2	0.4	0.2	0.1

From **Table 1**, it is clear that the most likely outcome is that the new product generates sales of £1,000,000, as that value has the highest probability.

Independent and conditional events

An independent event occurs when the outcome does not depend on the outcome of a previous event. For example, assuming that a dice is unbiased, then the probability of throwing a five on the second throw does not depend on the outcome of the first throw.

In contrast, with a conditional event, the outcomes of two or more events are related – ie the outcome of the second event depends on the outcome of the first event. For example, in Table 1, the company is forecasting sales for the first year of the new product. If, subsequently, the company attempted to predict the sales revenue for the second year, then it is likely that the predictions made will depend on the outcome for year one. If the outcome for year one was sales of $1,500,000, then the predictions for year two are likely to be more optimistic than if the sales in year one were $500,000.

The availability of information regarding the probabilities of potential outcomes allows the calculation of both an expected value for the outcome, and a measure of the variability (or dispersion) of the potential outcomes around the expected value (most typically standard deviation). This provides us with a measure of risk which can be used to assess the likely outcome.

Expected values and dispersion

Using the information regarding the potential outcomes and their associated probabilities, the expected value of the outcome can be calculated simply by multiplying the value associated with each potential outcome by its probability. Referring back to Table 1, regarding the sales forecast, then the expected value of the sales for year one is given by:

Expected value
= ($500,000 x 0.1) + ($700,000 x 0.2) + ($1,000,000 x 0.4) + ($1,250,000 x 0.2) + ($1,500,000)(0.1)

= $50,000 + $140,000 + $400,000 + $250,000 + $150,000
= $990,000

In this example, the expected value is very close to the most likely outcome, but this is not necessarily always the case. Moreover, it is likely that the expected value does not correspond to any of the individual potential outcomes. For example, the average score from throwing a dice is (1 + 2 + 3 + 4 + 5 + 6) / 6 or 3.5, and the average family (in the UK) supposedly has 2.4 children. A further point regarding the use of expected values is that the probabilities are based upon the event occurring repeatedly, whereas, in reality, most events only occur once.

In addition to the expected value, it is also informative to have an idea of the risk or dispersion of the potential actual outcomes around the expected value. The most common measure of dispersion is standard deviation (the square root of the variance), which can be illustrated by the example given in Table 2, concerning the potential returns from two investments.

Table 2: Potential returns from two investments

Invesment A	Investment A	Investment B	Investment B
Return	Probability of return	Return	Probability of return
8%	0.25	5%	0.25
10%	0.50	10%	0.50
12%	0.25	15%	0.25

To estimate the standard deviation, we must first calculate the expected values of each investment:

Investment A Expected value = (8% x 0.25) + (10% x 0.5) + (12% x 0.25) = 10%

Investment B Expected value = (5% x 0.25) + (10% x 0.5) + (15% x 0.25) = 10%

The calculation of standard deviation proceeds by subtracting the expected value from each of the potential outcomes, then squaring the result and multiplying by the probability. The results are then totalled to yield the variance and, finally, the square root is taken to give the standard deviation, as shown in Table 3.

Table 3: Application of standard deviation to potential returns

Investment A

Return (X)	Expected return (EV)	X - EV	$(X- EV)^2$	Probability (P)	$(X-EV)^2$ x P
8%	10%	-2%	4%	0.25	1%
10%	10%	0%	0%	0.50	0%
12%	10%	2%	4%	0.25	1%
				Variance	2%
				Standard deviation	1.414%

Table 3: Application of standard deviation to potential returns

Investment B

Return (X)	Expected return (EV)	X - EV	$(X- EV)^2$	Probability (P)	$(X-EV)^2$ x P
5	10%	-5%	25%	0.25	6.25%
10%	10%	0%	0%	0.50	0%
15	10%	5%	25%	0.25	6.25%
				Variance	12.5%
				Standard deviation	3.536%

In Table 3, although investments A and B have the same expected return, investment B is shown to be more risky by exhibiting a higher standard deviation. More commonly, the expected returns and standard deviations from investments and projects are both different, but they can still be compared by using the coefficient of variation, which combines the expected return and standard deviation into a single figure.

Coefficient of variation and standard error

The coefficient of variation is calculated simply by dividing the standard deviation by the expected return (or mean):

Coefficient of variation = standard deviation / expected return

For example, assume that investment X has an expected return of 20% and a standard deviation of 15%, whereas investment Y has an expected return of 25% and a standard deviation of 20%. The coefficients of variation for the two investments will be:

Investment X = 15% / 20% = 0.75 Investment Y = 20% / 25% = 0.80

The interpretation of these results would be that investment X is less risky, on the basis of its lower coefficient of variation. A final statistic relating to dispersion is the standard error, which is a measure most often confused with standard deviation. Standard deviation is a measure of variability of a sample, used as an estimate of the variability of the population from which the sample was drawn. When we calculate the sample mean, we are usually interested not in the mean of this particular sample, but in the mean of the population from which the sample comes. The sample mean will vary from sample to sample and the way this variation occurs is described by the 'sampling distribution' of the mean. We can estimate how much a sample mean will vary from the standard deviation of the sampling distribution. This is called the standard error (SE) of the estimate of the mean.

The standard error of the sample mean depends on both the standard deviation and the sample size:

SE = SD/√(sample size)

The standard error decreases as the sample size increases, because the extent of chance variation is reduced. However, a fourfold increase in sample size is necessary to reduce the standard error by 50%, due to the square root of the sample size being used. By contrast, standard deviation tends not to change as the sample size increases.

Decision-making criteria

The decision outcome resulting from the same information may vary from manager to manager as a result of their individual attitude to risk. We generally distinguish between individuals who are risk averse (dislike risk) and individuals who are risk seeking (content with risk). Similarly, the appropriate decision-making criteria used to make decisions are often determined by the individual's attitude to risk.

To illustrate this, we shall discuss and illustrate the following criteria:

1. Maximin
2. Maximax
3. Minimax regret

An ice cream seller, when deciding how much ice cream to order (a small, medium, or large order), takes into consideration the weather forecast (cold, warm, or hot). There are nine

possible combinations of order size and weather, and the payoffs for each are shown in Table 4.

Table 4: Decision-making combinations

Order/Weather	Cold	Warm	Hot
Small	$250	$200	$150
Medium	$200	$500	$300
Large	$100	$300	$750

The highest payoffs for each order size occur when the order size is most appropriate for the weather, i.e. small order/cold weather, medium order/warm weather, large order/hot weather. Otherwise, profits are lost from either unsold ice cream or lost potential sales. We shall consider the decisions the ice cream seller has to make using each of the decision criteria previously noted (note the absence of probabilities regarding the weather outcomes).

1. Maximin This criteria is based upon a risk-averse (cautious) approach and bases the order decision upon maximising the minimum payoff. The ice cream seller will therefore decide upon a medium order, as the lowest payoff is £200, whereas the lowest payoffs for the small and large orders are £150 and $100 respectively.

2. Maximax This criteria is based upon a risk-seeking (optimistic) approach and bases the order decision upon maximising the maximum payoff. The ice cream seller will therefore decide upon a large order, as the highest payoff is $750, whereas the highest payoffs for the small and medium orders are $250 and $500 respectively.

3. Minimax regret This approach attempts to minimise the regret from making the wrong decision and is based upon first identifying the optimal decision for each of the weather outcomes. If the weather is cold, then the small order yields the highest payoff, and the regret from the medium and large orders is $50 and $150 respectively. The same calculations are then performed for warm and hot weather and a table of regrets constructed (Table 5).

Table 5: Table of regrets

Order/Weather	Cold	Warm	Hot
Small	$0	$300	$600
Medium	$50	$0	$450
Large	$100	$200	$0

The decision is then made on the basis of the lowest regret, which in this case is the large order with the maximum regret of $200, as opposed to $600 and $450 for the small and medium orders.

Decision trees

The final topic to be discussed in this first article is the use of decision trees to represent a decision problem. Decision trees provide an effective method of decision-making because they:

- clearly lay out the problem so that all options can be challenged
- allow us to fully analyse the possible consequences of a decision
- provide a framework in which to quantify the values of outcomes and the probabilities of achieving them
- help us to make the best decisions on the basis of existing information and best guesses.

A comprehensive example of a decision tree is shown in Figures 1 to 4 (Shown by end of this chapter), where a company is trying to decide whether to introduce a new product or consolidate existing products. If the company decides on a new product, then it can be developed thoroughly or rapidly. Similarly, if the consolidation decision is made then the existing products can be strengthened or reaped. In a decision tree, each decision (new product or consolidate) is represented by a square box, and each outcome (good, moderate, poor market response) by circular boxes.

The first step is to simply represent the decision to be made and the potential outcomes, without any indication of probabilities or potential payoffs, as shown in Figure 1.

The next stage is to estimate the payoffs associated with each market response and then to allocate probabilities. The payoffs and probabilities can then be added to the decision tree, as shown in Figure 2. The expected values along each branch of the decision tree are calculated by starting at the right hand side and working back towards the left recording the relevant value at each node of the tree.

These expected values are calculated using the probabilities and payoffs. For example, at the first node, when a new product is thoroughly developed, the expected payoff is:

Expected payoff = (0.4 x $1,000,000) + (0.4 x $50,000) + (0.2 x $2,000) = $420,400

The calculations are then completed at the other nodes, as shown in Figure 3. We have now completed the relevant calculations at the uncertain outcome modes.

We now need to include the relevant costs at each of the decision nodes for the two new product development decisions and the two consolidation decisions, as shown in Figure 4.

The payoff we previously calculated for ‘new product, thorough development’ was $420,400, and we have now estimated the future cost of this approach to be $150,000. This gives a net payoff of $270,400.

The net benefit of ‘new product, rapid development’ is $31,400. On this branch, we therefore choose the most valuable option, ‘new product, thorough development’, and allocate this value to the decision node.

The outcomes from the consolidation decision are $99,800 from strengthening the products, at a cost of $30,000, and $12,800 from reaping the products without any additional expenditure.

By applying this technique, we can see that the best option is to develop a new product. It is worth much more to us to take our time and get the product right, than to rush the product to market. And it’s better just to improve our existing products than to botch a new product, even though it costs us less.

FIGURE 1: EXAMPLE DECISION TREE
Should we develop a new product or consolidate?

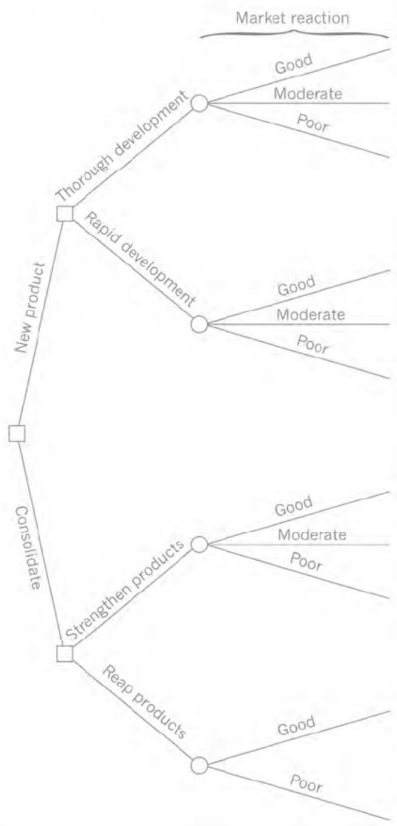
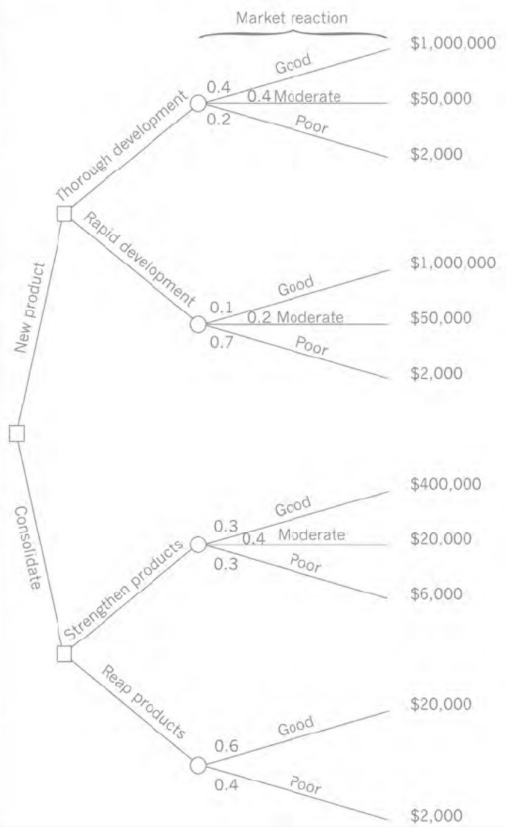
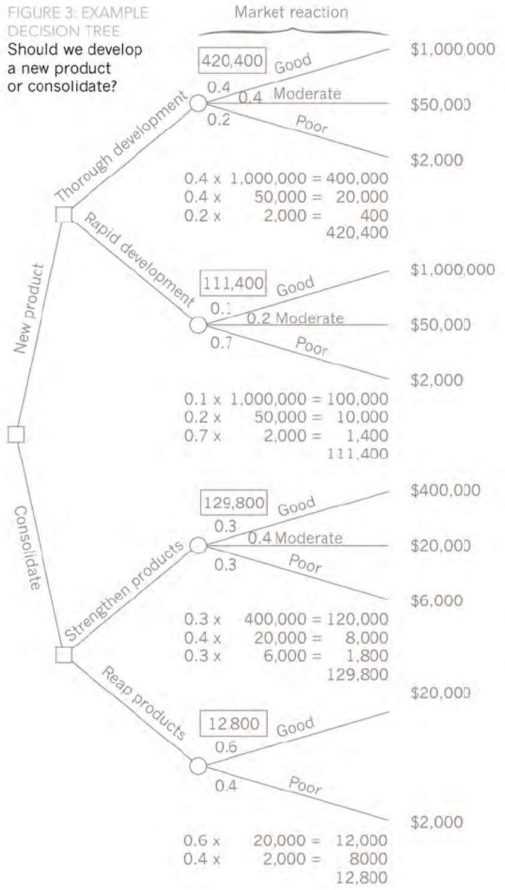
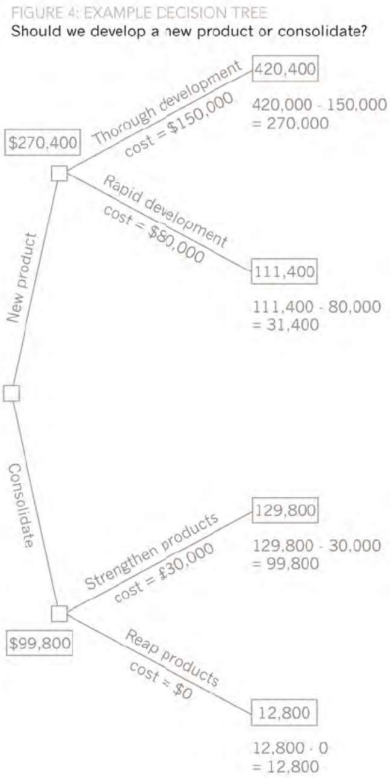


FIGURE 2: EXAMPLE DECISION TREE
Should we develop a new product or consolidate?







Written by a member of the Performance Management examining team

Chapter 13 All about budgeting – Part 1

Executive Summary

A **flexible budget** is a summary of revenues and costs across a range of different activity levels.

- A critical aspect of this approach is to determine fixed and variable costs
- Flexible budgeting happens at the beginning of a budgeting period

A **flexed budget** can then be created at the end of the budget period based on the actual activity level

Pros

- With flexible budgeting, managers will be able to plan and forecast more accurately.
- Performance management can be more meaningful

Cons

- High level of indirect costs, making it difficult to separate fixed and variable costs from total indirect costs

Budgeting is an essential part of planning, financial control, and performance management. It is a competency that must be acquired for anyone who is working in finance and accounting and is also a topic which is guaranteed to come up on your Performance Management (PM) exam. Expect to see it in Sections A or B, and there is a fair chance of it appearing in Section C, so you need to be ready to handle 20-mark questions from both a numerical and a discussion-based perspective. This series of articles will cover the budgeting approaches flexible budgeting, activity-based budgeting, rolling budgeting, zero-based budgeting, and beyond budgeting.

Flexible budgeting

A flexible budget is a summary of revenues and costs across a range of different activity levels. So instead of looking at only one activity level (which is called a 'fixed' budget—you should remember this from F2 [FMA]), various activity levels are considered. A critical aspect of this approach is to determine fixed and variable costs, which can then be expressed as a linear equation:

$$y = a + bx$$

Total cost (y) = Fixed cost (a) + (Variable cost per unit (b) * Activity level (x))

TC = FC + (VC * activity level)

With an understanding of revenue per unit and cost behaviours (i.e. fixed, variable, and stepped), financial results can then be budgeted within a range of activity levels.

You should be ready for complications on your PM exam, such as:

- dealing with a stepped cost
- incorporating the impact of a learning curve
- using the high/low method to separate fixed and variable costs from a total cost

Flexible vs flexed budget

Ensure you know the difference between these terms. **Flexible** budgeting happens at the beginning of a budgeting period—revenue, costs, and profit are forecast across a range of activity levels. With this information, a **flexed** budget can then be created at the end of the budget period based on the actual activity level. This flexed budget becomes a core part of financial control when using standard costing—the flexed budget answers the question, "What should our financial results be at the actual activity level?"

For more on this topic, see the Standard Costing section of your study materials.

Pros and cons

With flexible budgeting, managers will be able to plan and forecast more accurately. Performance management can be more meaningful as actual results can be easily compared to flexed results – total variances can then be calculated for each revenue and cost.

However, some businesses may have a high level of indirect costs, making it difficult to separate fixed and variable costs from total indirect costs.

Flexed budget example (Q Corfe, Q 20 & 21, September 2016, F5 Exam)

Corfe Co is a business which manufactures computer laptop batteries and it has developed a new battery which has a longer usage time than batteries currently available in laptops. The selling price of the battery is forecast to be $45. The maximum production capacity of Corfe Co is 262,500 units. The company's management accountant is currently preparing an annual flexible budget and has collected the following information so far:

Production (units)	185,000	200,000	225,000
	$	$	$
Material costs	740,000	800,000	900,000
Labour costs	1,017,500	1,100,000	1,237,500
Fixed costs	750,000	750,000	750,000

In addition to the above costs, the management accountant estimates that for each increment of 50,000 units produced, one supervisor will need to be employed. A supervisor's annual salary is $35,000.

Assuming the budgeted figures are correct, what would the flexed total production cost be if production is 80% of maximum capacity?

Solution

An 80% activity level is 210,000 units.

Material and labour are both variable costs. Material is $4 per unit and labour is $5.50 per unit, so total variable cost per unit is $9.50

Total variable costs = $9.50 x 210,000 units = $1,995,000

Fixed costs = $750,000

Supervision = $175,000 as five supervisors are required for a production level of 210,000 units.

Total annual budgeted cost allowance = $1,995,000 + $ 750,000 + $ 175,000 = $2,920,000

Part 2 Question

The management accountant has said that a machine maintenance cost was not included in the flexible budget but needs to be taken into account.

The new battery will be manufactured on a machine currently owned by Corfe Co which was previously used for a product which has now been discontinued. The management accountant estimates that every 1,000 units will take 14 hours to produce. The annual machine hours and maintenance costs for the machine for the last four years have been as follows:

	Machine time (hours)	Maintenance costs
		$'000
Year 1	**5000**	**850**
Year 2	**4400**	**735**
Year 3	**4850**	**815**
Year 4	**1800**	**450**

What is the estimated maintenance cost if production of the battery is 80% of the maximum capacity?

Solution

Variable cost per hour ($850,000 -$450,000)/(5,000 hours – 1,800 hours) = $125 per hour

Fixed cost ($850,000 – (5,000 x $125)) = $225,000

Number of machine hours required for production = 210 x 14 hours = 2,940 hours

Total cost ($225,000 + (2,940 x $125)) = $592,500, or $ 593,000 to the nearest $'000.

Written by Steve Willis, finance and accountancy trainer

Question

Which of the following describes a flexed budget?
A One that is set prior to the control period and not subsequently changed in response to changes in activity, costs or revenues
B One that is continuously updated by adding a further accounting period when the earliest accounting period has expired
C One that is changed in response to changes in the level of activity
D One that is changed in response to changes in costs

Answer: C

Flexed budgets are where the budget is updated at the end of the period to take into account the actual level of activity, but otherwise based on the original budget assumptions such as cost per unit. This makes it easier to compare actual performance against the budget.

Chapter 14 All about budgeting – Part 2

Executive Summary

Rolling budget approach.

This means that the budget will be updated more frequently than annually - either quarterly or even monthly - and a new budget period will be added to replace the expired period.

Pros

- The budget should be more accurate as it is updated more frequently, improving planning and control.
- This approach is also particularly useful in more unpredictable and volatile industries

Cons

- Rolling budgets require more work as managers will need training which is likely to be expensive and time-consuming.
- Also, conflict may emerge regarding performance targets - managers may complain of, 'changing goal posts'.
- Managers may also spend too much time preparing the budget, and not enough time controlling.

The issues related to implementing a rolling budget approach are:

- Training
- Information systems
- Performance measures

Rolling budget

Traditionally, budgets are prepared on an annual basis. After the annual budget is approved, it is usually ‘set in stone’ and not updated during this period. This approach can be useful for controlling a business in a stable, mature industry. However, as many organisations face more volatility and uncertainty, this arbitrary, one-year budget cycle may be too long and unpredictable for forecasts and targets to be meaningful. A lot can happen in one year - competitors can launch new products, consumer demand can change, and costs can fluctuate. This can render the annual budget obsolete.

A solution to this problem is the **rolling budget** approach. This means that the budget will be updated more frequently than annually - either quarterly or even monthly - and a new budget period will be added to replace the expired period. Using this approach, the budget will always extend one year into the future and will be continuously updated.

Pros and cons

The budget should be more accurate as it is updated more frequently, improving planning and control. This approach is also particularly useful in more unpredictable and volatile industries where it is difficult to plan one year into the future. Managers will revise their assumptions on a more regular basis, reducing the element of uncertainty.

However, rolling budgets require more work as managers will need training which is likely to be expensive and time-consuming. Also, conflict may emerge regarding performance targets - managers may complain of, 'changing goal posts'. Managers may also spend too much time preparing the budget, and not enough time controlling. The company may need to acquire new software which allows for regular updating of the budget. If the rolling budget is done on a stand-alone spreadsheet not linked to the company’s internal systems, data integrity problems can emerge.

Rolling budget example

Timana Co manufactures small-panel display screens for smartphones, car navigation and other consumer electronic products. This is a competitive industry characterised by short product life cycles, pricing pressure from online retailers and the need to continually innovate. The company has used annual, incremental budgeting, created on a standalone spreadsheet, as their primary control tool and uses this budget as the basis for performance targets for both sales managers and other managers.

The finance director recently attended a conference on ‘Budgeting in the Technology Industry’ and realised that the incremental budgeting system they have been using is no longer fit for purpose in a volatile industry like technology. He is aware that the budget has to be updated every quarter to take into account the changes in the market. He has therefore suggested that a rolling budget approach is undertaken.

The finance staff have been unhappy about the proposal, claiming that the existing computer system will not support the rolling budget approach and the sales managers were overheard saying: 'What is this rolling budget system and how will this affect our bonuses?'

The following budget has been prepared for the current year ending 31 December 20X8:

	Q1	Q2	Q3	Q4
	$	$	$	$
Revenue	480,000	494,400	509,232	524,509
Direct labour	(24,000)	(24,720)	(25,462)	(26,225)
Direct material	(48,000)	(49,440)	(50,923)	(52,451)
Contribution	**408,000**	**420,240**	**432,847**	**445,833**
Fixed production overheads	(120,000)	(120,000)	(130,000)	(130,000)
Administration costs	(210,000)	(210,000)	(216,300)	(216,300)
Profit	**78,000**	**90,240**	**86,547**	**99,533**

The budget was based on the following assumptions:

1. Sales volume would grow at the same fixed compound rate every quarter
2. Direct material and direct labour are wholly variable costs
3. Fixed production overheads would now be $10,000 higher from Q3 onwards as it was decided the machinery would require extra maintenance
4. Administration costs would increase by 3% in Q3 to account for an increase in the rent for the building

The actual results for Q1 were released.

	Q1
	$
Revenue	470,400
Direct labour	(24,480)
Direct material	(48,000)
Contribution	**397,920**
Fixed production overheads	(120,000)
Administration costs	(210,000)
Profit	**67,920**

The sales manager and production manager both commented that the actual results were different because of the following factors:

The sales manager said he had to reduce selling prices to boost demand as the market became more competitive. The decrease in revenue is accounted for solely by changes in selling prices. Sales volume is expected to grow as forecast in the original budget forecast.

The production manager confirmed that the direct labour cost was higher because of an increase in the minimum wage. It was also agreed that in Q3 the direct labour cost will increase by a one-off amount of $5,000 to account for additional training required under health and safety legislation.

The finance director decided to act on the comments he received from the finance team and the sales managers regarding training and the computer system. The first step was to create a position for a 'change manager;' this new manager will start at the beginning of Q2 with an annual salary of $150,000 and the administration cost will need to be adjusted to reflect this.

Required:

(a) Prepare Timana Co's rolling budget for the next four quarters (to the nearest $).

(Note: when preparing the budget the original assumptions are correct and should still be used).

(b) Discuss THREE issues related to the implementation of a rolling budget system in Timana Co.

Suggested solution:

- Question (a)

	A	B	C	D	E	F	G	H	I	J
1	**Rolling budget for the next four quarters**									
2		Q2 20X8	Q3 20X8	Q4 20X8	Q1 20X9					
3		$	$	$	$					
4	Revenue (W1)	484,512	499,047	514,019	529,439					
5	Direct labour (W2)	(25,214)	(30,971)	(26,750)	(27,552)					
6	Direct material (W3)	(49,440)	(50,923)	(52,451)	(54,024)					
7	**Contribution**	**409,858**	**417,153**	**434,818**	**447,863**					
8	Fixed production overhead (W4)	(120,000)	(130,000)	(130,000)	(130,000)					
9	Administration costs (W5)	(247,500)	(253,800)	(253,800)	(253,800)					
10	**Profit**	**42,358**	**33,353**	**51,018**	**64,063**					
11	**Workings:**									
12	All figures must be adjusted using the actual result of Q1.									
13	The budget will start from Q2 and similarly Q1 of 20X9 will be added.									
14	**W1 Revenue growth**									
15	Since the sales volume is growing every quarter, revenue will also grow proportionately.									
16	Growth= $494,400/$480,000=1.03 or $509,232/$494,400=1.03. A growth of 3% every quarter									
17	**W2 Direct labour**									
18	Direct labour is a variable cost, increasing by 3% every quarter to reflect the increase in sales volume									
19	In Q3, there is a one-off increase of $5,000 to reflect the training cost									
20	**W3 Direct material**									
21	Direct material is a variable cost, increasing by 3% every quarter to reflect the increase in sales volume									
22	**W4 Fixed production overhead**									
23	These costs will remain at $120,000 in Q2 and increase to $130,000 in Q3 onwards									
24	**W5 Administration**									
25	The change manager will be employed from Q2 with an annual salary of $150,000									
26	Every quarter, the administration costs will increase by $37,500 ($150,000/4)									
27	The 3% increase in administration costs has been adjusted already in the figures given in the question									

- Question (b)

(b) The issues related to implementing a rolling budget approach are:

Training

Training programmes for both the sales managers and the finance staff would help ensure that the rolling budget implementation goes smoothly. The sales managers have been complaining about the lack of understanding of rolling budgets. A training course for them would improve their knowledge amd reduce their resistance to change. Also, members of the finance team may not all have the same budgeting skills. A more technical training programme, including the use of a new software, would benefit the finance department.

Information systems

If the rolling budget is created and managed with a stand-alone spreadsheet tool, errors and data corruption problems may happen as budget updates will be more frequent, budgeting assumptions will change, and this information will come from different sources. A better solution is to use a software package that integrates with the company's systems. This might mean that Timana Co will need to invest in a new system, like an ERPS. This will ensure budgeting data is unified in one database and allow for multiple users to easily access and update the budget.

However, any new system will likely come at a substantial cost and require user support and training. Also, its implementation will probably be a time-consuming and expensive project.

Performance measures

The sales managers are frustrated as they don't know how their bonuses will be affected and they weren't consulted when the decision for the new system was taken. Unhappy and demotivated staff are more likely to seek new employment. This would cause disruption and higher costs as Timana Co would need to hire and train new sales managers.

However, moving to a rolling budget could actually be considered a good thing for the sales managers. Their targets will be more realistic, reflecting the current economic environment. For example, if forecasts were to worsen, their targets would reflect this, and they would not be assessed on factors out of their control.

Also, by moving to quarterly budget cycle, targets can be spread more evenly throughout the year which could improve staff motivation. With annual performance targets, managers may 'take it easy' and coast for the rest of the year after their target has been reached, say in month 9.

Conclusion

Overall, rolling budgets have many advantages which are useful in a changing environment such as the technology industry. Timana Co must ensure that the implementation of the rolling budget is done in such a way that staff are consulted, the benefits outweigh the costs, and that this change avoids causing disruption to productivity or morale.

Written by Steve Willis, finance and accountancy trainer

Chapter 15 All about budgeting – Part 3

Executive Summary

Activity-based budgeting (ABB)

ABB, in conjunction with ABC, focuses on understanding how overheads are consumed by the production process. Overheads are analysed, and ABB then looks at costs from the perspective of the activities that are required to satisfy the customer.

Pros

- 'Non-value adding' activities can be identified – these are activities which do not increase the customers' perceived worth of the final product.
- Value-adding activities and processes can then be automated or improved.
- Also, the budgeted costs and profit per product should be more accurate as costs per driver are determined after detailed analysis.

Cons

- ABB will require detailed analysis of overheads and measuring of activities. This can be a complex, costly and time-consuming project.
- If direct costs are more significant than indirect costs, and if the product range is narrow, the costs might outweigh the benefits of switching to ABB.

Activity-based budgeting

The rise of e-commerce, globalisation, and shorter product life-cycles are some of the factors increasing competitive rivalry across many business sectors. Also, indirect costs are becoming a higher percentage of total costs for many companies as technology and automation investments become more crucial to success. Because of this, managers need a deeper and more accurate understanding of the true cost of delivering their goods or services. Activity-based budgeting (ABB) is a tool that helps with this and is closely linked to activity-based costing (ABC), also in your syllabus.

Under an absorption costing system, indirect costs are pooled together and labelled 'overheads.' An overhead absorption rate is then calculated, based on a single driver – for example, direct labour hours (which can be easily found via payroll records). Overheads are then assigned to products on the basis of the overhead absorption rate and direct labour hours per unit. This cost per unit can then be used for the budgeting process.

ABB, in conjunction with ABC, focuses on understanding how overheads are consumed by the production process. Overheads are analysed, and ABB then looks at costs from the perspective of the activities that are required to satisfy the customer. Production and non-production activities are measured and quantified, and then a cost per activity (or cost per driver) is determined through detailed analysis of operations and costs. Once the cost per driver is calculated, managers can then create a more accurate budget based on departmental consumption of activities. ABB is essentially ABC in reverse.

Pros and cons

During an ABB/ABC exercise, 'non-value adding' activities can be identified – these are activities which do not increase the customers' perceived worth of the final product. These activities can then be eliminated. Value-adding activities and processes can then be automated or improved. Also, the budgeted costs and profit per product should be more accurate as costs per driver are determined after detailed analysis. ABB helps align value-added activities with objectives, reducing costs in the process.

However, there can be some disadvantages to using ABB. As stated above, ABB will require detailed analysis of overheads and measuring of activities. This can be a complex, costly and time-consuming project. If direct costs are more significant than indirect costs, and if the product range is narrow, the costs might outweigh the benefits of switching to ABB.

ABB example

Toy Co manufactures toys for toddlers and children. They are a small company and have a good reputation for producing high quality, innovative products. Their profit margins have been consistently higher than competitors in the same industry.

However, profitability has been slowly dropping over the past two years due to increasing overhead costs and the loss of several key customers because of shipping errors and missed delivery dates. The management accountant believes there are non-value added activities which can be removed to improve efficiency and reduce costs, and is considering the introduction of activity-based budgeting. He has decided to initially analyse two popular products, the 'Tod' and the 'Kid'.

Much of the production process is automated and occurs in batches. Orders are placed by large retail chains and demand is relatively constant during the year.

Operational information for each product is as follows:

	Tod	**Kid**
Quarterly demand (units)	30,000	36,000
Production batch size (units)	3000	1000
Order size (units)	150	120

Information for the quarter:

	Hours required	**Total Hours available**
Quality inspection time	15 per batch	860
Packaging and shipping time	1 hour per order	460

Requirement:

(a) Calculate the hours required for the next quarter and whether there is any spare capacity or shortage in the hours for:

- Quality inspection
- Packaging and shipping

(b) Discuss the implications of your findings in (a) for Toy Co's production process

Suggested solution:

- Question (a)

	A	B	C	D	E	F	G	H	I	J	K
1	If Toy Co would like to use the information given to improve its production process and improve profitability.										
2	It has to work out the number of batches and orders required for the quarter.										
3											
4	**Step 1-Calculation of batches and orders**										
5			**Tod**	**Kid**	**Total**						
6	Number of batches		10	36	**46**						
7											
8	Number of orders		200	300	**500**						
9											
10	**Step 2-Calculation of spare capacity/shortage for the quarter**										
11					**Required**	**Available**					
12	Quality inspection department (46*15)				690	860	170	Spare capacity			
13											
14	Packaging and shipping (500*1)				500	460	40	Shortage			
15											

- Question (b)

b)

Quality inspection time

There are 46 batches in total per quarter for both products. Each batch takes 15 hours to inspect, requiring a total of 690 hours for the quarter. This shows that the quality inspection department is operating at below capacity. The spare capacity is equal to 20% (170/860 x 100) of the hours available. Based on the information provided, management could cut costs in this department by reducing the number of staff or by redeploying them to another area of the business.

The information will also be useful for planning and forecasting. For instance, if demand was forecast to increase over the next several quarters, Toy Co would retain the quality control staff and save money by avoiding future employment and training costs.

Packaging and shipping time

There is currently a shortage of 40 hours in the packaging and shipping department. Toy Co requires 500 hours to complete the shipment of 500 orders, but only 460 hours are available. This shortage means that staff are rushing through to complete the orders, causing them to make mistakes in the shipping process. This shortage of hours might also be contributing to increased overtime payments, in turn contributing to increasing overheads. Toy Co can solve this problem in several ways. Firstly, they could analyse and improve the shipping and packing process. There may be manual administration tasks, such as completion of forms or labels, which could be automated with new IT systems.

Toy Co could increase capacity in the department by hiring a new member of staff. While this would create spare capacity, it would also give Toy Co more flexibility to meet an unexpected increase in demand. This decision is linked to long term planning.

Toy Co could increase capacity in the department by hiring a new member of staff. While this would create spare capacity, it would also give Toy Co more flexibility to meet an unexpected increase in demand. This decision is linked to long term planning.

Finally, Toy Co could offer their customers a bulk-purchase discount, enticing them to place larger orders. This would reduce the number of shipments required and the annual shipping costs.

Written by Steve Willis, finance and accountancy trainer

Chapter 16 All about budgeting – Part 4

Executive Summary

Zero-based budgeting

Incremental budgeting is a simple, straight-forward approach which uses either last year's budget or actual results as the starting base for the next year's budget, only making adjustments for new assumptions

Disadvantages:

- First, a cost centre manager might include 'slack' in their budget proposal – this means 'adding a little extra,' to cushion their budget.
- Last year's budget might also include outdated assumptions which would be carried forward into the new budgeting period using incremental budgeting.
- Managers may also be motivated to spend everything in their budget towards the end of the year to ensure they receive the same amount, or more, in the following year.

Zero-based budgeting is an approach to budgeting where all expenses must be justified at the start of each new budgeting period. This process starts at a 'zero-base,' and every organisational function is analysed for their needs and costs before an item is included in the budget.

Steps of ZBB

1. First, 'decision units' can be defined as business units, departments or programmes. Managers of each decision unit then evaluate the activities and processes they need to achieve their objectives.
2. This information is recorded in a 'decision package' detailing information on costs, resources required and different levels of output.
3. They are ranked, and a budget is created by allocating funds to the most attractive decision packages.

Pros

- Zero-based budgeting focuses the budgeting process on the objectives of the organisation by linking decision packages to organisational objectives.
- As it requires active involvement from managers and staff in preparing decision packages, their understanding of cost behaviours will be improved.
- This approach can result in better resource allocation and overall lower costs.

Cons

- Zero-based budgeting can be time-consuming. Data will need to be gathered for each decision package and some unknown information may need to be estimated.
- Zero-based budgeting also requires extensive document creation and management time when evaluating decision packages. Conflicts might arise in setting criteria for the ranking of decision packages, and more budgeting skills are needed by managers.
- The budgeting cycle is annual, so short-term goals may be prioritised instead of long-term goals.

Zero-based budgeting

Review: incremental budgeting

Incremental budgeting is a simple, straight-forward approach which uses either last year's budget or actual results as the starting base for the next year's budget, only making adjustments for new assumptions, for example, the estimated change in sales, raw material price inflation, or other incremental factors. Whilst this approach might be useful in a predictable, static environment, it comes with drawbacks.

First, a cost centre manager might include 'slack' in their budget proposal – this means 'adding a little extra,' to cushion their budget. Last year's budget might also include outdated assumptions which would be carried forward into the new budgeting period using incremental budgeting. Managers may also be motivated to spend everything in their budget towards the end of the year to ensure they receive the same amount, or more, in the following year.

Zero-based budgeting was developed in response to the issues surrounding incremental budgeting.

Zero-based budgeting is an approach to budgeting where all expenses must be justified at the start of each new budgeting period. This process starts at a 'zero-base,' and every organisational function is analysed for their needs and costs before an item is included in the budget.

First, 'decision units' can be defined as business units, departments or programmes. Managers of each decision unit then evaluate the activities and processes they need to achieve their objectives. This information is recorded in a 'decision package' detailing information on costs, resources required and different levels of output.

After the decision packages are generated, they are ranked, and a budget is created by allocating funds to the most attractive decision packages. Under zero-based budgeting, there is now a business justification for each item in the budget.

Pros and cons

Zero-based budgeting focuses the budgeting process on the objectives of the organisation by linking decision packages to organisational objectives. As it requires active involvement from managers and staff in preparing decision packages, their understanding of cost behaviours will be improved. This approach can result in better resource allocation and overall lower costs. Also, obsolete activities and processes will be cut out of the budget.

However, zero-based budgeting can be time-consuming. Data will need to be gathered for each decision package and some unknown information may need to be estimated. Zero-based budgeting also requires extensive document creation and management time when

evaluating decision packages. Conflicts might arise in setting criteria for the ranking of decision packages, and more budgeting skills are needed by managers. The budgeting cycle is annual, so short-term goals may be prioritised instead of long-term goals.

ZBB Example

Plainfield County Public Authority (PCPA) is a local public agency which provides services to the community, including a public library. PCPA is funded primarily from local tax revenues.

PCPA has recently moved from an incremental budgeting to a zero-based budgeting (ZBB) system. The central budget office now provides decision unit managers with PCPA's strategic plan, guidelines for budgeting and other support, and gives managers autonomy in how to develop their decision packages.

In the past, the library manager adjusted the budget to account for inflation and operational assumptions. Some of the costs the library currently incurs are as follows:

- Annual Staff costs: $140,000 for 5 members of staff
- Annual Information Systems (IS) maintenance costs: $12,500
- Annual website hosting costs: $1,750

The number of library visitors is expected to increase next year, increasing the workload for librarians. This will in turn increase staff costs by 15% due to overtime payments.

Despite the increase in the number of library visitors, the library has come under criticism for being 'old-fashioned', and the library manager wishes to respond to this. He is considering two projects for inclusion in his budget:

Decision package 1: Computer upgrade

With this proposal, only the computers will be replaced. The total cost for this upgrade will be $45,000. Annual IS maintenance costs will fall slightly to $9,000 as the new computing environment will require less support. Annual website costs will remain constant, and staff costs are expected to grow as projected above. This upgrade will not substantially change library operations.

Decision package 2: Computer upgrade and integrated library system

Under this proposal, new computers plus additional hardware and software will be purchased which automates the core library processes. The combined cost of the new system will be $98,500. This improvement will allow 'self-service' borrowing of books. Members of the public will scan books when borrowing and returning them, eliminating the need for interaction with a librarian. The new system will allow the library to reduce staff

members to 4, still earning the same average annual salary while avoiding additional overtime payments. Annual IS maintenance costs will increase to $22,000, and annual website costs will increase to $3,000.

The new system will use a dynamic website that lets library members see, in real-time, what books are available at the library and then reserve them online.

Requirements:

(a) Determine the cost of each decision package for the first year (ignore time value of money) and choose between the two options from both financial and non-financial perspectives.

(b) Discuss the advantages and disadvantages of moving to ZBB for the library.

Suggested solution:

(a)

	$
Computer upgrade	45, 000
Annual IS maintenance costs	9, 000
Website hosting	1, 750
Staff costs ($140,000 x 1.15)	161, 000
	216, 750

	$
Computer upgrade including integrated library system	98,500

Annual IS maintenance costs	22,000
Website hosting	3,000
Staff costs ($140,000 x 4/5 staff members)	112,000
	235,500

Information for the quarter:
Evaluation

Financial perspective

Decision package 2 is the more expensive option by $18, 750, or 8.7%. However, if the annual operating costs are considered, assuming the initial IT investment costs will be amortised, decision package 2 will bring annual savings of $34,750 (The difference between decision package 1 $171, 750 and decision package 2 $137, 000).

Non-financial perspective

Decision package 2 is the more innovative solution and addresses the criticism of the library being old-fashioned. This system will save community members' time as they will be able to search for and reserve books online without visiting the library. Also, the community and staff will have access to accurate and real-time information about what books are available. Automation of library tasks means librarians can be more focused on the needs of library visitors and allows for reducing the number of librarians in the future once the system is up and running. Satisfied visitors may also boost the library's reputation with positive comments and feedback on social media.

Even though the initial cost for decision package 2 is higher than decision package 1, it seems like the best option as it will reduce longer-term operational costs, improve efficiency, and improve the public's ability to access and use library resources.

(b)

Move to ZBB

Under ZBB, the library manager is more focused on the objectives and needs of the community when preparing their budget. Decision packages can be evaluated by the value for money provided for the community, not just by cost savings. The library manager is now more involved in the budgeting process and has found operational efficiencies and quality improvements in the process.

However, ZBB may be time-consuming for the library manager and can distract him from other important responsibilities. We also don't know if he has the appropriate skills to manage the budgeting process. As ZBB is an annual process and focused primarily on next year's budget, short-term objectives might take precedence over long-term benefits. For example, the new library system is more expensive in the short-term but leads to long-term cost savings and benefits – the ZBB approach does not highlight these long-term advantages.

Written by Steve Willis, finance and accountancy trainer

Question

The following statements have been made about zero based budgeting:
(1) Employees will focus on eliminating wasteful expenditure
(2) Short-term benefits could be emphasised over long-term benefits

Which of the above statements is/are true?

A 1 only
B 2 only
C Neither 1 nor 2
D Both 1 and 2

Answer: D

(1) is true – zero based budgeting focusses on only including costs relating to activities that the organisation wishes to continue to perform. Cost will not be included in the budget simply because they were in previous years budgets.
(2) is true. Budgets are mainly financial, and management may focus on increasing budgeted profits by removing expenses on activities that may benefit the organisation in the longer term.

Chapter 17 All about budgeting – Part 5

Executive Summary

Beyond Budgeting encompasses a modern, alternative approach to performance management that looks past the traditional, annual budget as the primary control tool of a company.

Advantages of Beyond Budgeting

1. Faster response
2. More innovative strategies
3. Lower costs
4. More loyal customers

Beyond Budgeting

Beyond Budgeting is more than just a method of preparing an annual budget. Instead, Beyond Budgeting encompasses a modern, alternative approach to performance management that looks past the traditional, annual budget as the primary control tool of a company.

The Beyond Budgeting philosophy begins with the recognition that many successful modern companies are moving away from traditional, top-down, command-and-control cultures and structures. These organisations are becoming more decentralised and nimble to stay competitive and are using approaches such Balanced Scorecards, ERP systems, and business process re-engineering to help them achieve this. Innovation and beating the competition to market with new products are new critical success factors for these companies. However, the budgeting processes of such companies are often stuck in the past.

The creators of Beyond Budgeting argue that in the modern business environment, the traditional approach to budgeting is no longer appropriate, and hinders performance. When a fixed, annual budget is used as the primary source of performance metrics for managers, for example hitting static sales or cost targets, problems can emerge:

- External factors, such as changing market conditions and competitors' actions, can render fixed, annual financial targets out-of-date and useless for fair performance evaluation.
- Modern organisations often depend upon teamwork, but traditional budgeting often rewards the manager to whom the team reports to.
- Financial performance reports that compare actual results against budgets are 'lagging' indicators. This means they only measure past performance and they don't help the user of the report identify the root cause of any issues flagged.

Beyond Budgeting emerged in the 1990s and its principles and main ideas are formally set out by the 'Beyond Budgeting Round Table' (BBRT), an international network that helps organisations make a move to Beyond Budgeting. As a *Performance Management* student it is a good idea to review this website and gain further insight into this modern performance management topic.

Advantages of Beyond Budgeting

The BBRT spells out four advantages that organisations will gain from making a move to Beyond Budgeting:

Faster response

Organisations using beyond budgeting, operate with speed and simplicity. This is achieved by giving managers more authority to act immediately within clear strategic boundaries and allowing them to more quickly meet customer needs. Bureaucracy is highly discouraged, and managers can react quickly to new threats and opportunities instead of being forced to follow to an outdated, annual plan.

More innovative strategies

Under the Beyond Budgeting approach, rewards go to teams and are based on relative performance versus peers, rather than individual incentives based on fixed targets. An open and self-managed environment is promoted, rather than a culture of sticking to a set of rules. This helps enable empowered teams, continuous improvement and innovation.

Lower costs

Under a fixed, annual budgeting approach, managers might be motivated to ‘pad’ their budgets (ie include extra resources, just in case) and have a ‘use it or lose it’ attitude (spend everything in your budget or you won’t get it next year). The net result of this is that the traditional budgeting process is protecting costs, rather than controlling or reducing costs.

Under Beyond Budgeting, this mentality is discouraged and instead managers are motivated to question fixed costs and look for cost reductions. Managers no longer see the budget as an entitlement to spend, but rather as a scarce resource that should only be used when it adds value to the customer.

More loyal customers

Organisations using beyond budgeting, put customer value at the core of their strategy and then adapt their processes to satisfy and delight them.

Written by Steve Willis, finance and accountancy trainer

Chapter 18 Comparing Budgeting Techniques

Executive Summary

This article evaluates the two main methods for preparing budgets - the incremental approach and the zero-based approach. Both of these have been used in both public sector and private sector organisations

Incremental budgeting is the traditional budgeting method whereby the budget is prepared by taking the current period's budget or actual performance as a base, with incremental amounts then being added for the new budget period.

Zero-based budgeting emerged first in the public sector in the 1960s, but it also gained popularity in the private sector and was adopted by Texas Instruments in 1969.

With zero-based budgeting, the budgeting process starts from a base of zero, with no reference being made to the prior period's budget or actual performance.

Stages in zero-based budgeting

(1). Activities are identified by managers.

(2). Management will then rank all the packages in the order of decreasing benefits to the organisation.

(3). The resources are then allocated based on order of priority up to the spending level.

It could be argued that ZBB is far more suitable for public sector than for private sector organisations.

The budgeting process is an essential component of management control systems, as it provides a system of planning, coordination and control for management. It is often an arduous process, however, and often strikes dread in the hearts of those involved in budget preparation.

In the public sector, the budgeting process can be even more difficult, since the objectives of the organisation are more difficult to define in a quantifiable way than the objectives of a private company. For example, a private company's objectives may be to maximise profit. The meeting of this objective can then be set out in the budget by aiming for a percentage increase in sales and perhaps the cutting of various costs. If, on the other hand, you are budgeting for a public sector organisation such as a hospital, then the objectives may be largely qualitative, such as ensuring that all outpatients are given an appointment within eight weeks of being referred to the hospital. This is difficult to define in a quantifiable way, and how it is actually achieved is even more difficult to define.

This leads onto the next reason why budgeting is particularly difficult in the public sector. Just as objectives are difficult to define quantifiably, so too are the organisation's outputs. In a private company the output can be measured in terms of sales revenue, for example. There is a direct relationship between the expenditure that needs to be input in order to achieve the desired level of output. In a hospital, on the other hand, it is difficult to define a quantifiable relationship between inputs and outputs. What is easier to compare is the relationship between how much cash is available for a particular area and how much cash is actually needed. Therefore, budgeting naturally focuses on inputs alone, rather than the relationship between inputs and outputs.

The purpose of this article is to critically evaluate the two main methods for preparing budgets - the incremental approach and the zero-based approach. Both of these have been used in both public sector and private sector organisations, with varying degrees of success.

Incremental budgeting

Incremental budgeting is the traditional budgeting method whereby the budget is prepared by taking the current period's budget or actual performance as a base, with incremental amounts then being added for the new budget period. These incremental amounts will include adjustments for things such as inflation, or planned increases in sales prices and costs. It is a common misapprehension of students that one of the biggest disadvantages of incremental budgeting is that it doesn't allow for inflation. Of course it does; by definition, an 'increment' is an increase of some kind. The current year's budget or actual performance is a starting point only.

Example: A school will have a sizeable amount in its budget for staff salaries. Let's say that in one particular year, staff salaries were $1.5m. When the budget is being prepared for the next year, the head teacher thinks that he will need to employ two new members of staff to teach languages, who will be paid a salary of $30,000 each (before any pay rises) and

also, that he will need to give all staff members a pay increase of 5%. Therefore, assuming that the two new staff will receive the increased pay levels, his budget for staff will be $1.638m [($1.5m +$30k + $30k) x 1.05]

It immediately becomes apparent when using this method in an example like this that, while being quick and easy, no detailed examination of the salaries already included in the existing $1.5m has been carried out. This $1.5m has been taken as a given starting point without questioning it. This brings us onto the reasons why incremental budgeting is not always seen as a good thing and why, in the 1960s, alternative methods of budgeting developed. Since I thoroughly believe that Performance Management students should always go into the exam with their metaphorical Performance Management toolbox in their hand, pulling tools out of the box as and when they need them in order to answer questions, I am going to list the benefits and drawbacks of both budgeting methods in a easy-to-learn format that should take up less room in the 'box'. The problem I often find with Performance Management students is that they think they can go into the exam without any need for such a toolbox, and while they may be able to get through some of the numerical questions simply from remembering techniques that they have learnt in the past, when it comes to written questions, they simply do not have the depth of knowledge required to answer them properly.

Benefits of incremental budgeting

- As indicated above, it is easy to prepare and is therefore quick. Since it is easy to prepare, it is also easily allocated to more junior members of staff.
- As well as being easy to prepare, it is easy to understand.
- Less preparation time leads to lower preparation costs.
- Prevents conflict between departmental managers since a consistent approach is adopted throughout the organisation.
- The impact of change can be seen quickly. For example, the increase of $138k in staff costs for the aforesaid school can quickly be traced back to the employment of two new staff members and a 5% pay increase because everything else in the staff salaries budget remained unchanged.

Drawbacks of incremental budgeting

- It assumes that all current activities and costs are still needed, without examining them in detail. In our school example above, we know that the head teacher has budgeted for two new language teachers. How carefully has he looked into whether both of these new teachers are actually needed? It may be that, with some timetable changes, the school could manage with only one new teacher, but there is no incentive for the head teacher to actually critically assess the current costs of $1.5m (provided, of course, that the funding is available for the two new teachers).
- With incremental budgeting, the head teacher does not have to justify the existing costs at all. If he can simply prove that there is an increase in the number of language lessons equivalent to two new staff's teaching hours, he can justify the cost of two new teachers. By

its very nature, incremental budgeting looks backwards rather than forwards. While this is not such a problem is fairly stable businesses, it will cause problems in rapidly changing business environments.

- There is no incentive for departmental managers to try and reduce costs and in fact, they may end up spending money just for the sake of it, knowing that if they don't spend it this year; they won't be allocated the cash next year, since they will be deemed not to need it.
- Performance targets are often unchallenging, since they are largely based on past performance with some kind of token increase. Therefore, managers are not encouraged to challenge themselves and inefficiencies from previous periods are carried forward into future periods. In our school example above, the head teacher may have hired an extra cook for the school kitchen when he thought that there was going to be greater demand for school dinners than there actually turned out to be. One of the cooks may be sitting idle in the kitchen most of the time but, with no-one looking at the existing costs, it is unlikely to change.

Time for change

After World War II, when money was tighter than ever, the problems with incremental budgeting began to give rise to a feeling that change was needed. By the 1960s, something called 'programme budgeting' began to develop in the US, introduced by the then US Secretary of Defence. This budgeting system requires objectives, outputs, expected results and then detailed costs to be given for every activity or program. Only when all of the budgets are then put together for all of the activities is the 'programme budget' then complete. This budgeting system requires a degree of transparency never before seen under incremental budgeting systems and, as you can imagine, it was not welcomed by the public sector at whom it was largely aimed. Therefore, it was closely followed by the development of zero-based budgeting. Zero-based budgeting emerged first in the public sector in the 1960s, but it also gained popularity in the private sector and was adopted by Texas Instruments in 1969. It gained notoriety in the 1970s when US President Jimmy Carter introduced it in the state of Georgia. While I could talk at more length about the history of zero-based budgeting, it's not particularly relevant for the Performance Management exam, so I won't.

Zero-based budgeting

With zero-based budgeting, the budgeting process starts from a base of zero, with no reference being made to the prior period's budget or actual performance. All of the budget headings, therefore, literally start with a balance of zero, rather than under incremental budgeting, when they all start with a balance at least equal to last year's budget or spend. Every department function is then reviewed comprehensively, with all expenditure requiring approval, rather than just the incremental expenditure requiring approval.

Zero-based budgeting tries to achieve an optimal allocation of resources to the parts of the business where they are most needed. It does this by forcing managers to justify every activity in their department as they know that, until they do this, the budget for their

department is zero. If they are unable to do this, they aren't allocated any resources and their work therefore stops (as does their employment within the organisation, at this point, presumably). In this way, all unjustifiable expenditure theoretically ceases. A questioning attitude is developed by management, who are constantly forced to ask themselves questions such as:

- Is the activity really necessary at all?
- What happens if the activity ceases?
- Is the current level of provision adequate?
- What other ways are there of carrying out the activity?
- How much should the activity cost?
- Do the benefits to be gained from the activity at least match the costs?

All of these questions are largely answered by breaking the budgeting process down into three distinct stages, as detailed below.

Stages in zero-based budgeting

(1). Activities are identified by managers. Managers are then forced to consider different ways of performing the activities. These activities are then described in what is called a 'decision package', which:

- analyses the cost of the activity
- states its purpose
- identifies alternative methods of achieving the same purpose
- establishes performance measures for the activity
- assesses the consequence of not performing the activity at all or of performing it at different levels.

As regards this last point, the decision package may be prepared at the base level, representing the minimum level of service or support needed to achieve the organisation's objectives. Further incremental packages may then be prepared to reflect a higher level of service or support.

For example, if ZBB was used by our head teacher in our example above, one of the activities that would have to be performed would be the provision or facilitation of school lunches. The school catering manager may consider three options. Option 1: providing an area where students can bring their own cold food to, with some sandwiches and other cold food and drinks being prepared and sold by catering staff. Option 2: providing a self-service cafeteria with hot and cold food and drinks available. Option 3: providing a full, hot food, catered service for pupils. The base level of service would be option 1, with options 2 and 3

being higher level service options. The school may, on the other hand, consider two mutually exclusive decision packages - providing a service internally or outsourcing the whole catering activity to an external provider.

While some form of cost-benefit analysis may be useful at this stage, a degree of quantitative analysis must also be incorporated. For example, cost-benefit analysis may show that the minimal level of provision for the school (option 1) is the most cost-effective. However, this would present the school in a negative light to parents of potential pupils and would deter some parents from sending their children to that school. Consequently, more able students may be discouraged from applying, thus leading to poorer results which, in turn, could have a negative impact on the school's future funding. Simple cost-benefit analysis would find it difficult to incorporate the financial effect of such considerations.

(2). Management will then rank all the packages in the order of decreasing benefits to the organisation. This will help management decide what to spend and where to spend it. This ranking of the decision packages happens at numerous levels of the organisation. For example, in the case of the school, the catering manager will rank the numerous decision packages that he prepares. Then, the headmaster will rank the catering packages amongst all the packages prepared for the rest of the school.

(3). The resources are then allocated based on order of priority up to the spending level.

Benefits of ZBB The benefits of ZBB are substantial. They would have to be otherwise no organisation would ever go to the lengths detailed above in order to implement it. These benefits are set out below:

- Since ZBB does not assume that last year's allocation of resources is necessarily appropriate for the current year, all of the activities of the organisation are re-evaluated annually from a zero base. Most importantly therefore, inefficient and obsolete activities are removed, and wasteful spending is curbed. This has got to be the biggest benefit of zero-based budgeting compared to incremental budgeting and was the main reason why it was developed in the first place.
- By its nature, it encourages a bottom-up approach to budgeting in order for ZBB to be used in practice. This should encourage motivation of employees.
- It challenges the status quo and encourages a questioning attitude among managers.
- It responds to changes in the business environment from one year to the next.
- Overall, it should result in a more efficient allocation of resources.

Drawbacks of ZBB

- Departmental managers may not have the necessary skills to construct decision packages. They will need training for this and training takes time and money.
- In a large organisation, the number of activities will be so large that the amount of paperwork generated from ZBB will be unmanageable.

- Ranking the packages can be difficult, since many activities cannot be compared on the basis of purely quantitative measures. Qualitative factors need to be incorporated but this is difficult. Top level management may not have the time or knowledge to rank what could be thousands of packages. This problem can be somewhat alleviated by having a hierarchical ranking process, whereby each level of managers rank the packages of the managers who report to them.
- The process of identifying decision packages and determining their purpose, costs and benefits is massively time consuming and costly. One solution to this problem is to use incremental budgeting every year and then use ZBB every three to five years, or when major change occurs. This means that an organisation can benefit from some of the advantages of ZBB without an annual time and cost implication. Another option is to use ZBB for some departments but not for others. Certain costs are essential rather than discretionary and it could be argued that it is pointless to carry out ZBB in relation to these. For example, heating and lighting costs in a school or hospital are expenses that will have to be paid, irrespective of the budget amount allocated to them. Incremental budgeting would seem to be more suitable for costs like these, as with building repair costs.
- Since decisions are made at budget time, managers may feel unable to react to changes that occur during the year. This could have a detrimental effect on the business if it fails to react to emerging opportunities and threats.
- The organisation's management information systems might be unable to provide the necessary information. It could be argued that ZBB is far more suitable for public sector than for private sector organisations. This is because, firstly, it is far easier to put activities into decision packages in organisations which undertake set definable activities. Local government, for example, have set activities including the provision of housing, schools and local transport. Secondly, it is far more suited to costs that are discretionary in nature or for support activities. Such costs can be found mostly in not for profit organisations or the public sector, or in the service department of commercial operations.

Conclusion

Since ZBB requires all costs to be justified, it would seem inappropriate to use it for the entire budgeting process in a commercial organisation. Why take so much time and resources justifying costs that must be incurred in order to meet basic production needs? It makes no sense to use such a long-winded process for costs where no discretion can be exercised anyway. Incremental budgeting is, by comparison, quick and easy to do and easily understood. However, the use of incremental budgeting indisputably gives rise to inefficiency, inertia and budgetary slack.

In conclusion, neither budgeting method provides the perfect tool for planning coordination and control. However, each method offers something positive to recommend it and one cannot help but think that the optimal solution lies somewhere between the two.

Written by a member of the Performance Management examining team

Questions

The following statements have been made about changing budgetary systems:
(1) The costs of implementation may outweigh the benefits
(2) Employees will always welcome any new system which improves planning and control within the organisation

Which of the above statements is/are true?

A 1 only
B 2 only
C Neither 1 nor 2
D Both 1 and 2

Answer: A

(1) is true as it is possible that the costs of a new budgetary system may outweigh the benefits.
(2) is not true. Employees are likely to resist new budgetary systems as they may involve additional work, and may be viewed as managers trying to achieve greater control.

Chapter 19 The Learning Rate and Learning Effect

Executive Summary

The **learning curve** is not about cost reduction. It is a human phenomenon that occurs because of the fact that people get quicker at performing repetitive tasks once they have been doing them for a while.

The **effect of the learning rate on labour time** will become much less significant as production increases. Eventually, the learning effect will come to an end altogether.

The **learning curve effect** will not always apply, of course. It flourishes where certain conditions are present. It is necessary for the process to be a repetitive one.

It is worth mentioning at this point that you should never round learning curve calculations to less than three decimal places.

The purpose of this article is twofold: first, it is to summarise the history of the learning curve effect and help candidates understand why it is important. Second, it is to look at what past learning curve questions have required of candidates and to clarify how future questions may go beyond this.

A brief history of the learning curve

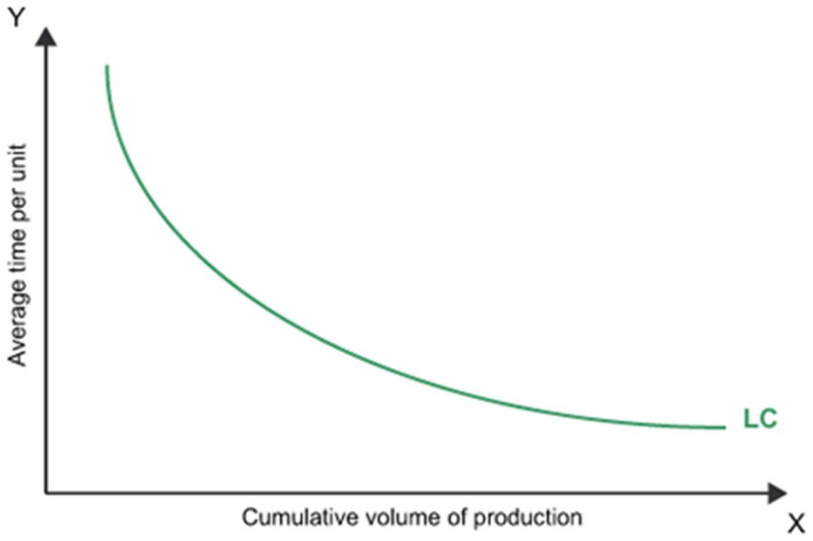
In practice, it is often found that the resources required to make a product decrease as production volumes increase. It costs more to produce the first unit of a product than it does to produce the one hundredth unit. In part, this is due to economies of scale since costs usually fall when products are made on a larger scale. This may be due to bulk quantity discounts received from suppliers, for example. The learning curve, effect, however, is not about this; it is not about cost reduction. It is a human phenomenon that occurs because of the fact that people get quicker at performing repetitive tasks once they have been doing them for a while. The first time a new process is performed, the workers are unfamiliar with it since the process is untried. As the process is repeated, however, the workers become more familiar with it and better at performing it. This means that it takes them less time to complete it.

The first reported observation of the learning curve goes as far back as 1925 when aircraft manufacturers observed that the number of man hours taken to assemble planes decreased as more planes were produced. TP Wright subsequently established from his research of the aircraft industry in the 1920s and 1930s that the rate at which learning took place was not random at all and that it was actually possible to accurately predict how much labour time would be required to build planes in the future. During World War II, US government contractors then used the learning curve to predict cost and time for ship and plane construction. Gradually, private sector companies also adopted it after the war.

The specific learning curve effect identified by Wright was that the cumulative average time per unit decreased by a fixed percentage each time cumulative output doubled. While in the aircraft industry this rate of learning was generally seen to be around 80%, in different industries other rates occur. Similarly, depending on the industry in question, it is often more appropriate for the unit of measurement to be a batch rather than an individual unit.

The learning process starts as soon as the first unit or batch comes off the production line. Since a doubling of cumulative production is required in order for the cumulative average time per unit to decrease, it is clearly the case that the effect of the learning rate on labour time will become much less significant as production increases. Eventually, the learning effect will come to an end altogether. You can see this in Figure 1 below. When output is low, the learning curve is really steep but the curve becomes flatter as cumulative output increases, with the curve eventually becoming a straight line when the learning effect ends.

Figure 1



The learning curve effect will not always apply, of course. It flourishes where certain conditions are present. It is necessary for the process to be a repetitive one, for example. Also, there needs to be a continuity of workers and they mustn't be taking prolonged breaks during the production process.

The importance of the learning curve effect

Learning curve models enable users to predict how long it will take to complete a future task. Management accountants must therefore be sure to take into account any learning rate when they are carrying out planning, control and decision-making. If they fail to do this, serious consequences will result. As regards its importance in decision-making, let us look at the example of a company that is introducing a new product onto the market. The company wants to make its price as attractive as possible to customers but still wants to make a profit, so it prices it based on the full absorption cost plus a small 5% mark-up for profit. The first unit of that product may take one hour to make. If the labour cost is $15 per hour, then the price of the product will be based on the inclusion of that cost of $15 per hour. Other costs may total $45. The product is therefore released onto the market at a price of $63. Subsequently, it becomes apparent that the learning effect has been ignored and the correct labour time per unit should is actually 0.5 hours. Without crunching through the numbers again, it is obvious that the product will have been launched onto the market at a price which is far too high. This may mean that initial sales are much lower than they otherwise would have been and the product launch may fail. Worse still, the company may have decided not to launch it in the first place as it believed it could not offer a competitive price.

Let us now consider its importance in planning and control. If standard costing is to be used, it is important that standard costs provide an accurate basis for the calculation of variances. If standard costs have been calculated without taking into account the learning

effect, then all the labour usage variances will be favourable because the standard labour hours that they are based on will be too high. This will make their use for control purposes pointless.

Finally, it is worth noting that the use of learning curve is not restricted to the assembly industries it is traditionally associated with. It is also used in other less traditional sectors such as professional practice, financial services, publishing and travel. In fact, research has shown that just under half of users are in the service sector.

How learning curves have been examined in the past

The learning curve effect has regularly been examined in Performance Management. For example, in December 2011, it was examined in conjunction with life cycle costing. Candidates were asked to calculate a revised lifecycle cost per unit after taking into account the learning effect. This involved working out the incremental labour time taken to produce the final 100th unit made before the learning effect ended. This is a fairly common exam requirement which tests candidates' understanding of the difference between cumulative and incremental time taken to produce a product and the application of the learning curve formula. It is worth mentioning at this point that you should never round learning curve calculations to less than three decimal places. In some questions, where the learning effect is small, over-rounding will lead to a candidate wiping out the entire learning effect and then the question becomes pointless.

The learning curve formula, as shown below, is always given on the formula sheet in the exam:

Y = axb Where Y = cumulative average time per unit to produce x units a = the time taken for the first unit of output x = the cumulative number of units produced b = the index of learning (log LR/log2) LR = the learning rate as a decimal

While a value for 'b' has usually been given in past exams there is no reason why this should always be the case. All candidates should know how to use a scientific calculator and should be sure to take one into the exam hall.

In June 2013, the learning effect was again examined in conjunction with lifecycle costing. Again, as has historically been the case, the learning rate was given in the question, as was the value for 'b'.

Back in June 2009, the learning curve effect was examined in conjunction with target costing. Once again, the learning rate was given, and a value for 'b' was given, but this time, an average cost for the first 128 units made was required. It was after this point that the learning effect ended, so the question then went on to ask candidates to calculate the cost for the last unit made, since this was going to be the cost of making one unit going forward in the business.

It can be seen, just from the examples given above, that learning curve questions have tended to follow a fairly regular pattern in the past. The problem with this is that candidates don't always actually think about the calculations they are performing. They simply practise past papers, learn how to answer questions, and never really think beyond this. In the workplace, when faced with calculations involving the learning effect, candidates may not be able to tackle them. In the workplace, the learning rate will not be known in advance for a new process and secondly, even if it has been estimated, differences may well arise between expected learning rates and actual learning rate experienced. Therefore, it seemed only right that future questions should examine candidates' ability to calculate the learning rate itself. This leads us on to the next section of the article.

Calculating the learning rate

The learning effect can continue to be examined with candidates being asked to calculate the time taken to produce an individual unit or a number of units of a product either when the learning curve is still in effect or when it has ended. In most questions 'b' has usually been given, however candidates can also be expected to calculate the learning rate itself. Here, the tabular method is the simplest way to answer the question.

Example 1

P Co operates a standard costing system. The standard labour time per batch for its newest product was estimated to be 200 hours, and resource allocation and cost data were prepared on this basis.

The actual number of batches produced during the first six months and the actual time taken to produce them is shown below:

Month	Incremental number of batches produced each month	Incremental labour hours taken to produce the batches
June	1	200
July	1	152
August	2	267.52
September	4	470.8
October	8	1,090.32
November	16	2,180.64

Required (a) Calculate the monthly learning rate that arose during the period. (b) Identify when the learning period ended and briefly discuss the implications of this for P Co.

Solution: (a) Monthly rates of learning

Month	Incremental number of batches	Incremental total hours	Cumulative number of batches	Cumulative total hours	Cumulative average hours per batch
June	1	200	1	200	200
July	1	152	2	352	176
August	2	267.52	4	619.52	154.88
September	4	470.8	8	1,090.32	136.29
October	8	1,090.32	16	2,180.64	136.29
November	16	2,180.64	32	4,361.28	136.29

Learning rate: 176/200 = 88% 154.88/176 = 88% 136.29/154.88 = 88%

Therefore the monthly rate of learning was 88%.

(b) End of learning rate and implications

The learning period ended at the end of September. This meant that from October onwards the time taken to produce each batch of the product was constant. Therefore, in future, when P Co makes decisions about allocating its resources and costing the product, it should base these decisions on the time taken to produce the eighth batch, which was the last batch produced before the learning period came to an end. The resource allocations and cost data prepared for the last six months will have been inaccurate since they were based on a standard time per batch of 200 hours.

P Co could try and improve its production process so that the learning period could be extended. It may be able to do this by increasing the level of staff training provided. Alternatively, it could try to incentivise staff to work harder through payment of bonuses, although the quality of production would need to be maintained.

Example 2

The first batch of a new product took six hours to make and the total time for the first 16 units was 42.8 hours, at which point the learning effect came to an end.

Required: (a) Calculate the rate of learning.

Solution: Again, the easiest way to solve this problem and find the actual learning rate is to use a combination of the tabular approach plus, in this case, a little bit of maths. There is an

alternative method that can be used that would involve some more difficult maths and use of the inverse log button on the calculator, but this can be quite tricky and candidates would not be expected to use this method. Should they choose to do so, however, full marks would be awarded, of course.

Cumulative number of products made	Cumulative total hours	Cumulative average time per unit
1	6	6
2	?	6 x r
4	?	$6 \times r^2$
8	?	$6 \times r^3$
16	42.8	$6 \times r^4$

Using algebra:

Step 1: Write out the equation: $42.8 = 16 \times (6 \times r^4)$

Step 2: Divide each side by 16 in order to get rid of the '16 x' on the right hand side of the equation: $2.675 = (6 \times r^4)$

Step 3: Divide each side by 6 in order to get rid of the '6 x' on the right hand side of the equation:$0.4458333 = r^4$

Step 4: take the fourth root of each side in order to get rid of the r^4 on the right hand side of the equation. You should have a button on your calculator that says r4 or $x^{1/y}$. Either of these can be used to find the fourth root (or any root, in fact) of a number. The key is to make sure that you can use your calculator properly before you enter the exam hall rather than trying to work it out under exam pressure. You then get the answer: r = 0.8171

This means that the learning rate = 81.71%.

Summary

The above two examples demonstrate the type of requirements that you may find in questions where you are asked to find the learning rate. All that we are doing is encouraging you to think a little and, in some case, perhaps use a little bit of the maths that, as a trainee accountant, you should be more than capable of applying.

Written by a member of the Performance Management examining team

Questions

You have just timed a person doing a job a few times. The first time it took the person 25 minutes, the second time it took 20 minutes and the third time it took 17.55 minutes.

What is the learning rate?

A 10%
B 20%
C 80%
D 90%

Answer: D

As cumulative output doubles, cumulative average time falls to the learning rate:
When output is 1, cumulative average time = 25 minutes.

When cumulative output is 2, cumulative average time per unit is ½ (20 + 25) = 22.5
⇒ learning rate = 22.5 ÷ 25 = 0.9 or 90%.

Chapter 20 Materials Mix and Yield Variances

Executive Summary

The purpose of this article is to cover the area of calculating materials mix and yield variances.

The **material usage variance** analyses the difference between how much actual material we used for our production relative to how much we expected to use, based on standard usage levels.

In terms of how we value this difference, it must be at standard cost.

When we talk about the **materials 'mix'** we are referring to the quantity of each material that is used to make our product ie we are referring to our inputs.

When we talk about **'yield'**, on the other hand, we are talking about how much of our product is produced, ie our output.

The **material usage variance** analyses the difference between how much actual material we used for our production relative to how much we expected to use, based on standard usage levels.

Where there is a difference between the actual level of output for a given set of inputs and the standard output for a given set of inputs, a **materials yield variance arises**.

Materials yield variance formula is:

(Actual yield – standard yield from actual input of material) x standard cost per unit of output

Some tips to help alleviate students' fears of variance analysis

Since long ago, variance analysis has been an area that evokes fear in students worldwide. Students enter the exam hall, desperately running through the formulae used to calculate all the different variances, fearful of forgetting them before they have managed to put pen to paper. Then the inevitable happens: they turn over the exam paper and a variance question stares back at them. Frantically, they scribble down all the formulae before they are lost forever. Alas, they can't remember it quite accurately enough. Is it actual quantity x standard price or standard quantity x actual price? Panic grips them. Logic flies out of the window. They move desperately on to the next question.

Does this sound like a familiar story to you? If it does, carry on reading. This article might help you. Many articles have been written about variance analysis over the years, but the purpose of this one is to cover the area of calculating materials mix and yield variances.

Material usage variance Most students have relatively little difficulty in calculating a straightforward material usage variance. As a reminder, let's recap on what the material usage variance is and how it is calculated. The material usage variance analyses the difference between how much actual material we used for our production relative to how much we expected to use, based on standard usage levels. So, for example, if we made 5,000 items using 11,000kg of material A and our standard material usage is only 2kg per item, then we clearly used 1,000kg of material more than we expected to (11,000kg – [2 kg x 5,000 items]). In terms of how we value this difference, it must be at standard cost. Any difference between standard and actual cost would be dealt with by the material price variance.

There can be many reasons for an adverse material usage variance. It may be that inferior quality material have been purchased, perhaps at a lower price. This may be reflected in a favourable material price variance: the materials were cheaper but as a result there was perhaps more waste.

On the other hand, it may be that changes to the production process have been made, or that increased quality controls have been introduced, resulting in more items being rejected. Whatever the cause, it can only be investigated after separate material usage variances have been calculated for each type of material used and then allocated to a responsibility centre.

Further variance analysis where several materials are used The fact that most products will be comprised of several, or sometimes hundreds of different materials, leads us back to the more detailed materials mix and yield variances that can be calculated in these instances. In many industries, particularly where the product being made undergoes a chemical process, it may be possible to combine different levels of the component materials to make the same product. This, in turn, may result in differing yields, dependent on the mix of materials that has been used. Note, when we talk about the materials 'mix' we are referring to the quantity of each material that is used to make our product ie we are referring

to our inputs. When we talk about 'yield', on the other hand, we are talking about how much of our product is produced, ie our output.

Materials mix variance In any process, much time and money will have been spent ascertaining the exact optimum mix of materials. The optimum mix of materials will be the one that balances the cost of each of the materials with the yield that they generate. The yield must also reach certain quality standards. Let us take the example of a chemical, C, that uses both chemicals A and B to make it. Chemical A has a standard cost of $20 per litre and chemical B has a standard cost of $25 per litre. Research has shown that various combinations of chemicals A and B can be used to make C, which has a standard selling price of $30 per litre. The best two of these combinations have been established as:

Mix 1: 10 litres of A and 10 litres of B will yield 18 litres of C; and

Mix 2: 8 litres of A and 12 litres of B will yield 19 litres of C.

Assuming that the quality of C produced is exactly the same in both instances, the optimum mix of materials A and B can be decided by looking at the cost of materials A and B relative to the yield of C.

Mix 1: (18 x $30) – (10 x $20) – (10 x $25) = $90 contribution

Mix 2: (19 x $30) – (8 x $20) – (12 x $25) = $110 contribution

Therefore, the optimum mix that minimises the cost of the inputs compared to the value of the outputs is mix 2: 8/20 material A and 12/20 material B. The standard cost per unit of C is (8 x $20)/19 + (12 x $25)/19 = $24.21. However, if the cost of materials A and B changes or the selling price for C changes, production managers may deviate from the standard mix. This would, in these circumstances, be a deliberate act and would result in a materials mix variance arising. It may be, on the other hand, that the materials mix changes simply because managers fail to adhere to the standard mix, for whatever reason.

Let us assume now that the standard mix has been set (mix 2) and production of C commences. 1,850kg of C is produced, using a total of 900kg of material A and 1,100kg of material B (2,000kg in total). The actual costs of materials A and B were at the standard costs of $20 and $25 per kg respectively. How do we calculate the materials mix variance?

The variance is worked out by first calculating what the standard cost of our 1,850kg worth of C would have been if the standard mix had been adhered to, and comparing that figure to the standard cost of our actual production, using our actual quantities. My preferred approach has always been to present this information in a table as shown in **Table 1** below. The materials mix variance will be $46,000 – $45,500 = $500 favourable.

Remember: it is essential that, for every variance you calculate, you state whether it is favourable or adverse. These can be denoted by a clear 'A' or 'F' but avoid showing an adverse variance by simply using brackets. This leads to mistakes.

The formula for this is shown below, but if you were to use it, the variance for each type of material must be calculated separately.

(Actual quantity in standard mix proportions – actual quantity used) x standard cost

As a student, I was never a person to blindly learn formulae and rely on these to get me through. I truly believe that the key to variance analysis is to understand what is actually happening. If you understand what the materials mix variance is trying to show, you will work out how to calculate it. However, for those of you who do prefer to use formulae, the workings would be as follows:

Material A: (800kg – 900kg) x $20 = $2,000 Adverse

Material B: (1,200kg – 1,100kg) x $25 = $2,500 Favourable

Net variance = $500 favourable

In this particular example, I have kept things simple by keeping all actual costs in line with the standards. The reality is that, in the real world, actual costs will often vary from standards. Why haven't I covered this above? Because any variance in materials price is always dealt with by the materials price variance. If we try and bring this into our mix variance, we begin distorting the one thing that we are trying to understand – how the difference in materials mix has affected our cost, rather than how the difference in price has affected our cost.

Why haven't I considered the fact that although our materials mix variance is $500 favourable, our changed materials mix may have produced less of C than the standard mix? Because this, of course, is where the materials yield variance comes into play.

The materials mix variance focuses on inputs, irrespective of outputs. The materials yield variance, on the other hand, focuses on outputs, taking into account inputs.

Material usage variance Most students have relatively little difficulty in calculating a straightforward material usage variance. As a reminder, let's recap on what the material usage variance is and how it is calculated. The material usage variance analyses the difference between how much actual material we used for our production relative to how much we expected to use, based on standard usage levels. So, for example, if we made 5,000 items using 11,000kg of material A and our standard material usage is only 2kg per item, then we clearly used 1,000kg of material more than we expected to (11,000kg – [2 kg x 5,000 items]). In terms of how we value this difference, it must be at standard cost. Any

difference between standard and actual cost would be dealt with by the material price variance.

There can be many reasons for an adverse material usage variance. It may be that inferior quality material have been purchased, perhaps at a lower price. This may be reflected in a favourable material price variance: the materials were cheaper but as a result there was perhaps more waste.

On the other hand, it may be that changes to the production process have been made, or that increased quality controls have been introduced, resulting in more items being rejected.

Whatever the cause, it can only be investigated after separate material usage variances have been calculated for each type of material used and then allocated to a responsibility centre.

Further variance analysis where several materials are used The fact that most products will be comprised of several, or sometimes hundreds of different materials, leads us back to the more detailed materials mix and yield variances that can be calculated in these instances. In many industries, particularly where the product being made undergoes a chemical process, it may be possible to combine different levels of the component materials to make the same product. This, in turn, may result in differing yields, dependent on the mix of materials that has been used. Note, when we talk about the materials 'mix' we are referring to the quantity of each material that is used to make our product ie we are referring to our inputs. When we talk about 'yield', on the other hand, we are talking about how much of our product is produced, ie our output.

Materials mix variance In any process, much time and money will have been spent ascertaining the exact optimum mix of materials. The optimum mix of materials will be the one that balances the cost of each of the materials with the yield that they generate. The yield must also reach certain quality standards. Let us take the example of a chemical, C, that uses both chemicals A and B to make it. Chemical A has a standard cost of $20 per litre and chemical B has a standard cost of $25 per litre. Research has shown that various combinations of chemicals A and B can be used to make C, which has a standard selling price of $30 per litre. The best two of these combinations have been established as:

Mix 1: 10 litres of A and 10 litres of B will yield 18 litres of C; and

Mix 2: 8 litres of A and 12 litres of B will yield 19 litres of C.

Assuming that the quality of C produced is exactly the same in both instances, the optimum mix of materials A and B can be decided by looking at the cost of materials A and B relative to the yield of C.

Mix 1: (18 x $30) – (10 x $20) – (10 x $25) = $90 contribution

Mix 2: (19 x $30) – (8 x $20) – (12 x $25) = $110 contribution

Therefore, the optimum mix that minimises the cost of the inputs compared to the value of the outputs is mix 2: 8/20 material A and 12/20 material B. The standard cost per unit of C is (8 x $20)/19 + (12 x $25)/19 = $24.21. However, if the cost of materials A and B changes or the selling price for C changes, production managers may deviate from the standard mix. This would, in these circumstances, be a deliberate act and would result in a materials mix variance arising. It may be, on the other hand, that the materials mix changes simply because managers fail to adhere to the standard mix, for whatever reason.

Let us assume now that the standard mix has been set (mix 2) and production of C commences. 1,850kg of C is produced, using a total of 900kg of material A and 1,100kg of material B (2,000kg in total). The actual costs of materials A and B were at the standard costs of $20 and $25 per kg respectively. How do we calculate the materials mix variance?

The variance is worked out by first calculating what the standard cost of our 1,850kg worth of C would have been if the standard mix had been adhered to, and comparing that figure to the standard cost of our actual production, using our actual quantities. My preferred approach has always been to present this information in a table as shown in **Table 1** below. The materials mix variance will be $46,000 – $45,500 = $500 favourable.

Remember: it is essential that, for every variance you calculate, you state whether it is favourable or adverse. These can be denoted by a clear ‘A’ or ‘F’ but avoid showing an adverse variance by simply using brackets. This leads to mistakes.

The formula for this is shown below, but if you were to use it, the variance for each type of material must be calculated separately.

(Actual quantity in standard mix proportions – actual quantity used) x standard cost

As a student, I was never a person to blindly learn formulae and rely on these to get me through. I truly believe that the key to variance analysis is to understand what is actually happening. If you understand what the materials mix variance is trying to show, you will work out how to calculate it. However, for those of you who do prefer to use formulae, the workings would be as follows:

Material A: (800kg – 900kg) x $20 = $2,000 Adverse

Material B: (1,200kg – 1,100kg) x $25 = $2,500 Favourable

Net variance = $500 favourable

In this particular example, I have kept things simple by keeping all actual costs in line with the standards. The reality is that, in the real world, actual costs will often vary from standards. Why haven’t I covered this above? Because any variance in materials price is

always dealt with by the materials price variance. If we try and bring this into our mix variance, we begin distorting the one thing that we are trying to understand – how the difference in materials mix has affected our cost, rather than how the difference in price has affected our cost.

Why haven't I considered the fact that although our materials mix variance is $500 favourable, our changed materials mix may have produced less of C than the standard mix? Because this, of course, is where the materials yield variance comes into play.

The materials mix variance focuses on inputs, irrespective of outputs. The materials yield variance, on the other hand, focuses on outputs, taking into account inputs.

Table 1: Calculating the standard cost of 1,850kg worth of C (standard mix)

Actual usage in standard proportions:			Actual usage in actual proportions:	Var.
	$		**$**	**$**
A = 800kg (8/20 x 2,000kg) x $20	16,000	A = 900kg x $20	18,000	**2,000A**
B = 1,200kg (12/20 x 2,000kg) x $25	30,000	B = 1,100kg x $25	27,500	**2,500F**
Total	**46,000**	**Total**	**45,500**	**500F**

Materials yield variance Where there is a difference between the actual level of output for a given set of inputs and the standard output for a given set of inputs, a materials yield variance arises. In our optimum mix, we calculated that 20kg of inputs of A and B should produce 19kg of our output, C. We are effectively saying that there is a loss rate of 5% (20 – 1/20) in our process, ie our outputs, in kg, should be 95% of our inputs. Applying this to our example then, we can say that we would have expected our inputs of 2,000kg to yield an output of 95% of 2,000kg, ie 1,900 kg. Our actual yield was only 1,850kg, which is 50kg less than we would have expected. To calculate the materials yield variance, all we have to do is value this difference between the actual yield (1,850kg) and the expected yield for our given set of inputs (1,900kg) at the standard cost of our output, C, ie at $24 per kg. It is easy to see how to calculate this when we look at it logically and present it in a very simple table as shown in **Table 2**.

No formula really needs to be learnt if you understand the logic behind the materials yield variance and grasp the principle that any price differences between actual and standard are always dealt with by the price variance alone. However, for those who do prefer to use a formula, the materials yield variance formula is:

(Actual yield – standard yield from actual input of material) x standard cost per unit of output

(1,850kg – 1,900kg) x $24 = $1,200 Adverse

Making observations about variances From our example, it can be seen that there is a direct relationship between our materials mix variance and our materials yield variance. By using a mix of materials that was different from standard, we have resulted in a saving of $500, in standard cost terms. However, the downside of this is that our cheaper mix of materials has resulted in a significantly lower yield of material C than we would have got had our standard mix of materials been adhered to. This yield was $1,200 lower than it would have been, which is over double the amount that we saved by using a cheaper mix of materials.

Overall, by netting the two variances off against each other, we have an adverse material usage variance of $700 ($1,200 A less $500 F). As indicated earlier on in the article, this could have been calculated on its own, without breaking it down further into its mix and yield elements, by comparing the quantity of materials we expected to use (based on standard usage) for our actual production to the quantity of material we actually did use for our production.

Using my preferred method of a table, our calculations would look like **Table 3**.

Actual production of 1,850kg requires an input of 1,947kg (1,850 x 100/95) in total of A and B

Table 2: Value difference between actual and expected yield at standard cost of C

Actual yield	Standard yield for actual quantities input	Difference	Standard cost per kg	Var.
1,850kg	1,900kg	50kg	$24	$1,200A

Table 3: Calculating the adverse material usage variance ($700)

Standard quantity for actual production	$	Actual quantity	$	Var.
A = 780kg (1,947 x 8/20) x $20	15,600	A = 900kg x $20	18,000	**2,400A**
B =1,168kg (1,947 x 12/20) x $25	29,200	B = 1,100kg x $25	27,500	**1,700F**
Total	**44,800**	**Total**	**45,500**	**700A**

Again, if you like to learn the formula, this is shown below, although it would have to be applied separately to each type of material.

(Standard quantity for actual production – actual quantity) x standard cost

Understanding the bigger picture Now that you understand how to deal with the numerical side of materials mix and yield variances, and the fact that these are simply a detailed breakdown of the material usage variance, it is also important to stress the fact that quality issues cannot really be dealt with by this variance analysis. I have mentioned the fact that there is a direct relationship between the mix and the yield variance and that

neither of these can be considered in isolation. In addition to this, however, it is also essential to understand the importance of producing products that are of a consistently good quality. It can be tempting for production managers to change the product mix in order to make savings; these savings may lead to greater bonuses for them at the end of the day. However, if the quality of the product is adversely affected, this is damaging to the reputation of the business and hence its long-term survival prospects. While substituting poor quality input materials may in some cases lead to yield volumes that are the same as those achieved with higher quality materials, the yield may not be of the same quality.

Unfortunately, this factor cannot be incorporated into the materials yield variance. In the long run, it may be deduced from an adverse sales volume variance, as demand for the business's product decreases, but it is likely to take time for sales volumes to be affected. Any sales volume variance that does arise as a result of poor quality products is likely to arise in a different period from the one in which the mix and yield variances arose, and the correlation will then be more difficult to prove.

Similarly, poorer quality materials may be more difficult to work with; this may lead to an adverse labour efficiency variance as the workforce takes longer than expected to complete the work. This, in turn, could lead to higher overhead costs, and so on.

Fortunately, consequences such as these will occur in the same period as the mix variance and are therefore more likely to be identified and the problem resolved. Never underestimate the extent to which a perceived 'improvement' in one area (eg a favourable materials mix variance) can lead to a real deterioration in another area (eg decreased yield, poorer quality, higher labour costs, lower sales volumes, and ultimately lower profitability). Always make sure you mention such interdependencies when discussing your variances in exam questions. The number crunching is relatively simple once you understand the principles; the higher skills lie in the discussion that surrounds the numbers.

Written by a member of the Paper F5 examining team

Questions

The following statements have been made about the materials mix variance for a company manufacturing different products using the same type of material (measured in kgs):

(i) The mix variance can be calculated by taking the difference between the actual quantity in the standard mix and the actual quantity in the actual mix, then multiplying it by the actual cost per kg

(ii) The mix variance arises because there is a difference between what the input should have been for the output achieved and the actual output

Which of the above statements is/are correct?

A Neither (i) nor (ii)
B Both (i) and (ii)
C (i) only
D (ii) only

Answer: A

The first statement is incorrect as the difference between actual quantity in standard mix and the actual quantity in the actual mix is valued at the standard cost per kg, not the actual cost.

The second statement is incorrect as that is the definition of the yield variance.

Chapter 21 Decentralisation and the Need for Performance Measurement

Executive Summary

Decentralisation is essentially the delegation of decision-making responsibility.

Profit centres and investment centres are often referred to as divisions. Divisionalisation refers to the delegation of profit-making responsibility.

Cost centres Standard costing variance analysis is commonly used in the measurement of cost centre performance.

Profit centres Controllable profit statements are commonly used in profit centres.

Investment centres In an investment centre, managers have the responsibilities of a profit centre plus responsibility for capital investment. Two measures of divisional performance are commonly used:

1. Return on investment (ROI) %
2. Residual income

Relative merits of ROI and residual income

Problems common to both ROI and residual income

Non-financial performance indicators (NFPIs)

Balanced scorecard

Perspective

1. Financial
2. Customer
3. Internal process
4. Learning and growth

Areas to measure should relate to an organisation's critical success factors.

Critical success factors (CSFs) are performance requirements which are fundamental to an organisation's success and can usually be identified from an organisation's mission statement, objectives and strategy.

Key performance indicators (KPIs) are measurements of achievement of the chosen critical success factors.

Decentralisation is essentially the delegation of decision-making responsibility. All organisations decentralise to some degree; some do it more than others. Decentralisation is a necessary response to the increasing complexity of the environment that organisations face and the increasing size of most organisations. Nowadays it would be impossible for one person to make all the decisions involved in the operation of even a small company, hence senior managers delegate decision-making responsibility to subordinates.

One danger of decentralisation is that managers may use their decision-making freedom to make decisions that are not in the best interests of the overall company (so called dysfunctional decisions). To redress this problem, senior managers generally introduce systems of performance measurement to ensure – among other things – that decisions made by junior managers are in the best interests of the company as a whole. Table 1 below details different degrees of decentralisation and typical financial performance measures employed.

TABLE 1

Responsibility structure	Manager's area of responsibility	Typical financial performance measure
Cost centre	Decisions over costs	Standard costing variances
Profit centre	Decisions over costs and revenues	Controllable profit
Investment centre	Decisions over costs, revenues and assets	Return on investment and residual income

Profit centres and investment centres are often referred to as divisions. Divisionalisation refers to the delegation of profit-making responsibility.

What makes a good performance measure?

A good performance measure should:

- provide incentive to the divisional manager to make decisions which are in the best interests of the overall company (goal congruence)
- only include factors for which the manager (division) can be held accountable
- recognise the long-term objectives as well as short-term objectives of the organisation.

Traditional performance indicators

Cost centres Standard costing variance analysis is commonly used in the measurement of cost centre performance. It gives a detailed explanation of why costs may have departed from the standard. Although commonly used, it is not without its problems. It focuses almost entirely on short-term cost minimisation which may be at odds with other objectives, for example, quality or delivery time. Also, it is important to be clear about who is responsible for which variance – is the production manager or the purchasing manager (or both) responsible for raw material price variances? There is also the problem with setting standards in the first place – variances can only be as good as the standards on which they are based.

Profit centres Controllable profit statements are commonly used in profit centres. A pro-forma statement is given in Table 2.

TABLE 2

	$	$
Revenue (external)	XXX	
(internal)	XXX	
		XXX
Controllable divisional variable costs		(XXX)
Controllable divisonal fixed costs		(XXX)
Controllable divisional profit		**XXX**
Other traceable divisional variable costs		(XXX)
Other traceable divisional fixed costs		(XXX)
Traceable divisional profit		**XXX**
Apportioned head office costs		(XXX)
Net profit		**XXX**

The major issue with such statements is the difficulty in deciding what is controllable or traceable. When assessing the performance of a manager we should only consider costs and revenues under the control of that manager, and hence judge the manager on controllable profit. In assessing the success of the division, our focus should be on costs and revenues that are traceable to the division and hence judge the division on traceable profit. For example, depreciation on divisional machinery would not be included as a controllable cost in a profit centre. This is because the manager has no control over investment in fixed assets. It would, however, be included as a traceable fixed cost in assessing the performance of the division.

Investment centres In an investment centre, managers have the responsibilities of a profit centre plus responsibility for capital investment. Two measures of divisional performance are commonly used:

1. Return on investment (ROI) % = controllable (traceable) profit/controllable (traceable) investment.
2. Residual income = controllable (traceable) profit – an imputed interest charge on controllable (traceable) investment.

Note: Imputed interest is calculated by multiplying the controllable (traceable) investment by the cost of capital.

Example 1 below demonstrates their calculation and some of the drawbacks of return on investment.

Example 1: Division X is a division of XYZ plc. Its net assets are currently $10m and it earns a profit of $2.2m per annum. Division X's cost of capital is 10% per annum. The division is considering two proposals.

- Proposal 1 involves investing a further $1m in fixed assets to earn an annual profit of $0.15m.
- Proposal 2 involves the disposal of assets at their net book value of $2.3m. This would lead to a reduction in profits of $0.3m.

Proceeds from the disposal of assets would be credited to head office not to Division X.

Required: Calculate the current ROI and residual income for Division X and show how they would change under each of the two proposals.

	A	B	C	D	E	F
1	**Current situation**					
2						
3	ROI	$2.2m/$10m = 22%				
4	RI	$2.2m - ($10m x 10%) = $1.2m				
5						
6	**Proposal 1**					
7						
8	ROI	$2.35m/$11m = 21.4%				
9	RI	$2.35m - ($11m x 10%) = $1.25m				
10						
11	**Proposal 2**					
12						
13	ROI	$1.9m/$7.7m = 24.7%				
14	RI	$1.9m/(7.7m x 10%) = $1.13m				
15						
16						

Commentary: Under the current situation ROI exceeds the cost of capital and residual income is positive. The division is performing well.

In simple terms Proposal 1 is acceptable to the company. It offers a rate of return of 15% ($0.15m/$1m) which is greater than the cost of capital. However, divisional ROI falls and this could lead to the divisional manager rejecting Proposal 1. This would be a dysfunctional decision. Residual income increases if Proposal 1 is adopted and this performance measure should lead to goal congruent decisions.

In simple terms Proposal 2 is not acceptable to the company. The existing assets have a rate of return on 13% ($0.3m/$2.3m) which is greater than the cost of capital and hence should not be disposed of. However, divisional ROI rises and this could lead to the divisional manager accepting Proposal 2. This would be a dysfunctional decision. Residual income decreases if Proposal 2 is adopted and once again this performance measure should lead to goal congruent decisions.

Relative merits of ROI and residual income

Return on investment is a relative measure and hence suffers accordingly. For example, assume you could borrow unlimited amounts of money from the bank at a cost of 10% per annum. Would you rather borrow £100 and invest it at a 25% rate of return or borrow $1m and invest it at a rate of return of 15%?

Although the smaller investment has the higher percentage rate of return, it would only give you an absolute net return (residual income) of $15 per annum after borrowing costs. The bigger investment would give a net return of $50,000. Residual income, being an absolute measure, would lead you to select the project that maximises your wealth.

Residual income also ties in with net present value, theoretically the best way to make investment decisions. The present value of a project's residual income equals the project's net present value. In the long run, companies that maximise residual income will also maximise net present value and in turn shareholder wealth. Residual income does, however, experience problems in comparing managerial performance in divisions of different sizes. The manager of the larger division will generally show a higher residual income because of the size of the division rather than superior managerial performance.

In addition because RI uses the cost of capital to calculate an imputed interest this cost of capital can be adjusted to recognise the risk in different projects.

Problems common to both ROI and residual income

The following problems are common to both measures:

- Identifying controllable (traceable) profits and investment can be difficult.
- If used in a short-term way they can both overemphasise short-term performance at the expense of long-term performance. Investment projects with positive net present value can show poor ROI and residual income figures in early years leading to rejection of projects by managers (see Example 2).
- If assets are valued at net book value, ROI and residual income figures generally improve as assets get older. This can encourage managers to retain outdated plant and machinery (see Example 2).
- Both techniques attempt to measure divisional performance in a single figure. Given the complex nature of modern businesses, multi-faceted measures of performance are necessary.
- Both measures require an estimate of the cost of capital, a figure which can be difficult to calculate.

Example 2: PQR plc is considering opening a new division to manage a new investment project. Forecast cash flows of the new project are as follows:

	A	B	C	D	E	F	G
1	Year	0	1	2	3	4	5
2	Net cash flow ($m)	(5.0)	1.4	1.4	1.4	1.4	1.4

PQR's cost of capital is 10% per annum. Straight line depreciation is used.

Required: Calculate the project's net present value and its projected ROI and residual income over its five-year life.

NPV

	A	B	C	D	E	F	G
1	**NPV**						
2	Year	0	1	2	3	4	5
3	Net cash flow ($m)	(5.0)	1.4	1.4	1.4	1.4	1.4
4	Discount factors at 10%	1	0.91	0.83	0.75	0.68	0.62
5	Present value	(5.0)	1.27	1.16	1.05	0.95	0.87
6	**NPV = $0.30m**						

ROI

	A	B	C	D	E	F
1	**ROI**					
2	Year	1	2	3	4	5
3	Opening inv at NBV	5.0	4.0	3.0	2.0	1.0
4	Net cash flow ($m)	1.4	1.4	1.4	1.4	1.4
5	Straight line depreciation	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
6	Profit	0.4	0.4	0.4	0.4	0.4
7	**ROI**	**8%**	**10%**	**13%**	**20%**	**40%**

Residual income

	A	B	C	D	E	F
1	**RI**					
2	Year	1	2	3	4	5
3	Profit (as above)	0.4	0.4	0.4	0.4	0.4
4	Imputed interest	(0.5)	(0.4)	(0.3)	(0.2)	(0.1)
5	**RI**	-0.1	0	0.1	0.2	0.3

Commentary: This example demonstrates two points. Firstly, it illustrates the potential conflict between NPV and the two divisional performance measures. This project has a positive NPV and should increase shareholder wealth. However, the poor ROI and residual income figures in the first year could lead managers to reject the project. Secondly, it shows the tendency for both ROI and residual income to improve over time. Despite constant annual cash flows, both measures improve over time as the net book value of assets falls. This could encourage managers to retain outdated assets.

Non-financial performance indicators (NFPIs)

In recent years, the trend in performance measurement has been towards a broader view of performance, covering both financial and non-financial indicators. The most well-known of these approaches is the balanced scorecard proposed by Kaplan and Norton. This approach attempts to overcome the following weaknesses of traditional performance measures:

Single factor measures such as ROI and residual income are unlikely to give a full picture of divisional performance.

- Single factor measures are capable of distortion by unscrupulous managers (eg by undertaking Proposal 2 in Example 1).
- They can often lead to confusion between measures and objectives. If ROI is used as a performance measure to promote the maximisation of shareholder wealth some managers will see ROI (not shareholder wealth) as the objective and dysfunctional consequences may follow.
- They are of little use as a guide to action. If ROI or residual income fall they simply tell you that performance has worsened, they do not indicate why.

The balanced scorecard approach involves measuring performance under four different perspectives, as follows:

Perspective	Question
Financial	How do we look to shareholders?
Customer	How do customers see us?
Internal process	What must we excel at internally?
Learning and growth	Can we continue to improve and create value?

The term 'balanced' is used because managerial performance is assessed under all four headings. Each organisation has to decide which performance measures to use under each heading. Areas to measure should relate to an organisation's critical success factors.

Critical success factors (CSFs) are performance requirements which are fundamental to an organisation's success (for example innovation in a consumer electronics company) and can usually be identified from an organisation's mission statement, objectives and strategy.

Key performance indicators (KPIs) are measurements of achievement of the chosen critical success factors. Key performance indicators should be:

- specific (ie measure profitability rather than 'financial performance', a term which could mean different things to different people)
- measurable (ie be capable of having a measure placed upon it, for example, number of customer complaints rather than the 'level of customer satisfaction')
- relevant, in that they measure achievement of a critical success factor

Example 3 demonstrates a balanced scorecard approach to performance measurement in a fictitious private sector college training ACCA students.

Example 3

Perspective	CSF	KPI
Financial	Shareholder wealth	Dividend yield % Increase in share price
	Cash flow	Actual v budget Receivables days
Customer	Exam success	College pass rate v national average Premier college status Tutor grading by students
	Flexibility	Average number of course variants offered per subject (eg full-time, day release, evening
Internal process	Resource utilisation	% room occupancy Average class size Tutor teaching days
Learning and growth	Innovation in products I.T	% of revenue from products < 1 year old Number of online enrolments

The balanced scorecard approach to performance measurement offers several advantages:

- it measures performance in a variety of ways, rather than relying on one figure
- managers are unlikely to be able to distort the performance measure as bad performance is difficult to hide if multiple performance measures are used
- it takes a long-term perspective of business performance
- success in the four key areas should lead to the long-term success of the organisation
- it is flexible as what is measured can be changed over time to reflect changing priorities
- 'what gets measured gets done' – if managers know they are being appraised on various aspects of performance they will pay attention to these areas, rather than simply paying 'lip service' to them.

The main difficulty with the balanced scorecard approach is setting standards for each of the KPIs. This can prove difficult where the organisation has no previous experience of performance measurement. Benchmarking with other organisations is a possible solution to this problem.

Allowing for trade-offs between KPIs can also be problematic. How should the organisation judge the manager who has improved in every area apart from, say, financial performance? One solution to this problem is to require managers to improve in all areas, and not allow trade-offs between the different measures.

Written by a member of the Performance Management examining team

Questions

At the start of the year, a division has non-current assets of $4 million and makes no additions or disposals during the year. Depreciation is charged at a rate of 10% per annum on all non-current assets held at the end of the year.

Working capital is $0·5 million at the start of the year although this is expected to increase by 20% by the end of the year. The budgeted profit of the division after depreciation is $1·2m.

What is the expected ROI of the division for the year, based on average capital employed?

A 27·59%
B 26·37%
C 18·39%
D 31·58%

Answer: A

Working
Opening capital employed: $4m + $0·5m = $4·5m
Closing capital employed: ($4m x 0·9) + ($0·5 x 1·2) = $3·6m + $0·6 = $4·2m
Average capital employed = $4·35m
Profit after depreciation = $1·2m
Therefore ROI = $1·2m/$4·35m = 27·59%

Chapter 22 Tackling Performance Evaluation Questions

Executive Summary

Tips on answering performance evaluation question

Understand time management

The golden rule here is to spend 1.8 minutes per mark if you are on the paper-based exam, and 1.7 minutes per mark if you are on the CBE.

Avoid the common mistake of over-calculating and under-writing—use time management to properly split your time between the two tasks.

Effective reading and planning

Avoid the common mistake of not linking your answer to the scenario. Identifying the key issues in the scenario is the first thing you should do.

Go for the 'easy marks first'

Deciding what to calculate

Avoid the common mistake of going no further than the calculations—the verb is 'discuss,' not 'calculate.'

Understand the 'own figure rule' and how it works in your favour

Avoid the common mistake of trying to get your numbers perfect in section C, scenario-based questions. Do your calculations and quickly move to the discussion when time is up

Moving on to the more challenging part: the discussion

How to gain marks

To gain a mark, your discussion needs to add value to your calculation and be linked to business performance.

How much should you write

A good method for getting your ideas down quickly when discussing calculations is to use the writing and structuring tool, Calculate—Comment—Discuss.

What to write about

Use your calculations as a guide to structure your answer

Make sure your answer is linked to the scenario

Include a summary

Performance evaluation is a regularly examined requirement in the F5 Performance Management exam, and is a topic that students tend to misunderstand and struggle with. Often examined as a full, 20 mark requirement, the task of crafting a free-form answer that incorporates both supporting calculations and a developed, written discussion is a daunting task. It's unfamiliar territory moving up from F2, and requires a specific set of new skills.

This article is meant to help you successfully tackle this type of question. We will work through an approach for planning and answering this requirement, look at common mistakes and how to avoid them, and finally take you through a completed answer that demonstrates the points in this article.

Before you go further, please download Question 31, Jungle Co, from the September 2016 exam. It will serve as our model throughout this article.

The requirement

Discuss the financial and non-financial performance of Jungle Co for the year ending 31 Aug 2016.

Note: there are 7 marks available for calculations and 13 marks available for discussion. (20 marks)

As you see, this type of question can be examined as a single, 20-mark requirement – performance on this single answer can mean the difference between a pass or a fail. In order to gain passing marks on this requirement, it's suggested to use and practice an approach that you can replicate under the stress of exam day.

A recommended approach is:

- Understand time management and use your time appropriately
- Effectively read the requirement and plan your answer
- Decide on your calculations and complete your workings
- Plan your discussion
- Write up your discussion using a standard approach to paragraph creation

Let's now work through this approach step-by-step, using Jungle Co as an example.

Understand time management

Time management is critical skill to develop for passing ACCA exams – if you don't grasp the concepts we talk about here, you will struggle not only with F5 but with all your future exams.

The idea is to set a time limit for everything you do in your exam. This keeps you on track, and helps you ensure that you cover all questions in the exam. The golden rule here is to spend 1.8 minutes per mark if you are on the paper-based exam, and 1.7 minutes per mark if you are on the CBE. This gives you a bit of buffer time in either case.

As question Jungle Co is 20 marks, you should spend either 34 or 36 minutes in your exam on this question. Do not exceed this time limit: if you run out of time, move to the next question and come back later if you manage to find extra time.

You will have a lot to do in this short window so the next step is to allocate the total time allowed to the different tasks you'll complete in the question. With performance evaluation questions, you are usually given an important indication about this: **the spread of marks between calculating and discussing.**

For example, in question Jungle Co, it's clearly stated that the calculations are worth a maximum of 7 marks and the discussion is worth 13 marks. **This means that after reading and planning, you should spend 1/3 of the remaining time on your calculations, and 2/3 on writing your discussion.**

When time is up for the calculations you need to move to your discussion, even if you feel you haven't done enough. Most of the marks will come from your analysis, not your calculations. Students are often more comfortable performing calculations than writing up an essay, so there is a real risk that you will spend too much time on the numbers and fail to give enough attention to the discussion.

Avoid the common mistake of over-calculating and under-writing—use time management to properly split your time between the two tasks.

Effective reading and planning

For the scenario-based, section C questions, it's critical that you carefully read the scenario as it will contain important information that you need to relate to your answer. Finding this important information is your job here. Bring a highlighter marker with you (or use the highlighter tool in the CBE) and highlight this information as you find it.

For example, in question Jungle Co, you will find important information about the company's product lines, new services offered, and a big change in their approach to logistics.

Time management: you will need roughly 15-20% of your total question time to properly read and plan your answer. Spend this time and do a good plan here to save you time later in your answer.

Avoid the common mistake of not linking your answer to the scenario. Identifying the key issues in the scenario is the first thing you should do.

Go for the 'easy marks first'

This is an important concept relevant to all your ACCA exams and one that successful students follow carefully. 'Easy marks first' means that you should always go for the easiest requirements in a question first, saving the difficult things for later, even if it means taking things out of order. It also applies to sections A and B of the exam: do the easiest OTs first; flag the difficult ones and come back to them later. If you are going to run out of time, do so while attempting the difficult parts of the question that you might not get anyway, rather than missing out on easy marks.

This is relevant to performance analysis questions. The easiest marks in this type of question (and also the logical starting place as you can't evaluate performance without information) come from the calculations, so start here and get warmed up. But remember, don't over-do it with calculations, move to the discussion when time is up.

Deciding what to calculate

After you've completed your reading and planning, the next step is to do your calculations. But before you start, you need to decide WHAT you are going to calculate. Your goal is to evaluate performance from a broad perspective. This means you should use as wide a range of data as possible.

For example, the requirement in question Jungle Co clearly states, 'discuss the "*financial"* and "*non-financial"* performance of the company'. Linking these two perspectives is a core aspect of the Performance Management syllabus: it's critical that you show, and contrast, both perspectives in your answer.

Also, in question Jungle Co, you are practically overloaded with data as there are five separate sections, 19 rows, and two columns of data. Don't get bogged down here; find several relevant ratios from each section, rather than calculate everything possible from one section.

For example, after you identify that there are multiple sections of data, you could calculate some of the following indicators, touching on as many sections as you can:

Section(s)	Indicator

Profit and loss statement	Change in revenue Change in gross margin Change in net margin
Breakdown of revenue and cost of sales	Change in revenue by product line Change cost of sales by product line Change in gross margin by product line
Administration expenses	Change in customer service costs Change in customer service costs as a % of admin expenses
Non–financial data	Change in on-time deliveries Change in late deliveries Change in customer complaints Change in the % of customers who complain Change in late Gold member deliveries

These indicators are only some examples of what you could calculate – it also might be more than you can do in the allocated time. But don't worry; you don't need to calculate this full list of indicators to reach passing marks. What's more important is to (a) not to over-do it calculating at the expense of your discussion (b) use data from all the sections (c) use the ratios effectively in your discussion.

Time management: when 1/3 of the time remaining after reading and planning is up, stop your calculations and move to the discussion. It's normal to feel that there is more that you can do, but resist this urge; it's time to move to the discussion part of your answer.

Avoid the common mistake of going no further than the calculations—the verb is 'discuss,' not 'calculate.' Only 7 out of 20 marks in this question are available for the numbers.

Understand the 'own figure rule' and how it works in your favour

In a time-pressurised situation like your F5 exam, occasional slips of the calculator can happen. While your section A and B answers need to be numerically correct to get marks, in section C constructed response questions, the 'own figure rule' applies. This means that any numbers you calculate incorrectly will be assumed correct when used later in your answer.

For example, if sales are increasing, but you accidentally show this change as decreasing, you will miss the mark for the working. However, in your narrative, if you correctly discuss the impact of sales decreasing, you will get full marks here *even though your calculation was incorrect*. But, make sure you show your workings.

In the computer based exam, your workings will be in spreadsheet cells and markers will look at your formulae if needed.

Avoid the common mistake of trying to get your numbers perfect in section C, scenario-based questions. Do your calculations and quickly move to the discussion when time is up – don't waste valuable time double-checking everything. If there happens to be a mistake in your numbers, but you interpret this error correctly, you will get full marks in your discussion.

Moving on to the more challenging part: the discussion

Now that you've completed the calculations, it's time to move to the part that many students dread: writing the discussion. This is the area where many students struggle. But, with the right approach to writing and enough practice, you can develop the skills to successfully handle this component of the requirement.

Time management: as noted above, make sure you give this part of your answer the full 2/3 of your remaining time after reading and planning – you will need it.

How to gain marks

It's not enough to simply restate your calculation in words – for example, 'sales increased by 20 percent'. It's also not enough to only give short, generic statements – for example, 'this is a good sign'. You'll get no marks for either – you must say more.

To gain a mark, your discussion needs to add value to your calculation and be linked to business performance. This means you need to say WHY you think something has changed and LINK this to information in the scenario. You need to bring multiple pieces of information together to actually discuss, or assess, performance.

Avoid the common mistakes of (a) only restating your calculations as words, and (b) only providing short, one-phrase, generic comments. Neither of these approaches will generate any marks.

How much should you write

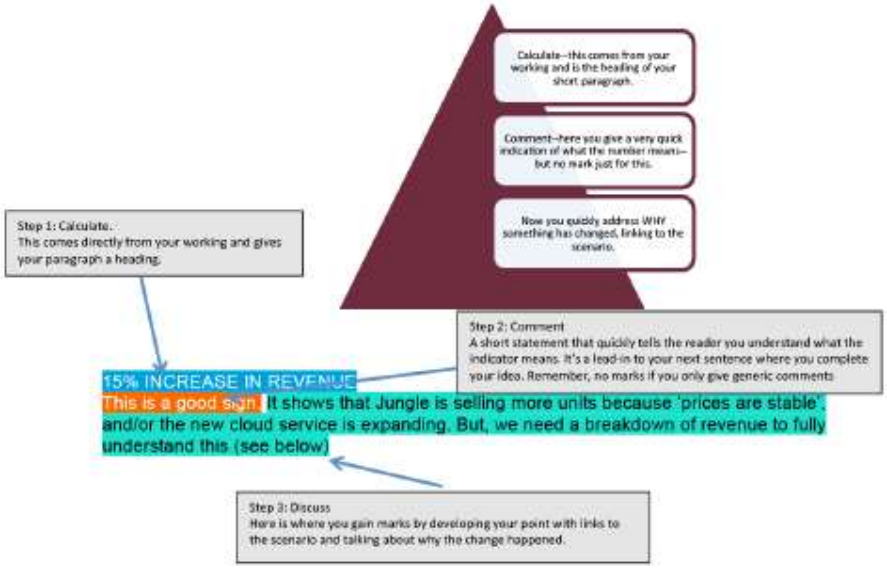
There is no set rule for section C questions that says, 'one mark = one point.' Each question will have a different marking guide. But, you need some reference to help you decide how

much you should write. Work with the general rule when the requirement is ‘discuss’ or ‘evaluate: 1 mark = 1 idea. To generate an idea that is linked to the scenario, use roughly 3 short sentences or independent clauses.

A good method for getting your ideas down quickly when discussing calculations is to use the writing and structuring tool, Calculate—Comment—Discuss. This approach to structuring paragraphs ensures that you write enough, link to the scenario, and efficiently generate marks.

‘Calculate-Comment-Discuss’ works like this.

One Paragraph



Click the diagram to view larger version

Avoid the common mistake of creating a ‘sea of words’—this means pages of writing without headings and structure. Use short, concise paragraphs, with headings and subheadings, in your answer.

Also, make sure you stick to the requirement, which is ‘discuss'. Don’t drift by giving recommendations or definitions—stay focused on the requirement.

Avoid the common mistake of ‘requirement drift’. You won’t get marks for answering invented requirements.

What to write about

Use your calculations as a guide to structure your answer: focus on the areas of performance that have changed the most and that seem to be linked to the important information in the scenario. It's important to focus on the RELATIVE change of an indicator as this shows the significance of what you're writing about.

Avoid the common mistake of producing and writing about absolute changes. Only relative changes will be awarded marks.

For example, in question Jungle Co, late Gold member deliveries increased from 2% to 14%. What's important is that missed deliveries increased 700% in relative terms—this shows a major problem, coming from the move to in-house logistics, potentially threatening continued growth of the business. **This is what you are going after in your discussion**. To state the change simply as in increase of 14 percentage points misses the point and won't generate marks.

Make sure your answer is linked to the scenario

In section C, it's critical that you relate your answer to the scenario to gain marks.

For example, in question Jungle Co, you learned during reading and planning that the company took logistics in-house instead of using international delivery companies. You then see in your calculations that both missed deliveries and complaints have increased. It's likely there is a cause-effect relationship here: moving to in-house logistics caused the quality to drop, which is driving the increase in complaints. Bring this kind of relationship out in your answer.

Avoid the common mistake of producing generic comments—link your ideas directly to the issues in the scenario to gain marks.

Include a summary

If time permits, include an overall summary at the end of your answer, tying the financial and non-financial perspectives together.

Example of a good answer

We've just looked a detailed approach to helping you construct an answer that can get you a comfortable pass on this type of question. Here is a worked example, demonstrating the points in this article.

Workings

Change in total revenue	(94,660 – 82,320)/82,320	15.0% increase
Change net margin	((23,809/94,660) – (15,602/82,320))/(15,602/82,320)	32.7% increase
Change in admin expenses	(2,760 – 1,720)/1,720	60.5% increase
Change in distribution expenses	(13,420 – 13,180)/13,180	1.8% increase
Change in Revenue by product line:		
Household goods	(38,990 – 41,160)/41,160	5.3% decrease
Electronic goods	(41,870 – 32,640)/32,640	28.3% increase
Cloud computing services	(12,400 – 6,520)/6,520	90.2% increase
Change in gross margin by product line:		
Household goods	((15,596/38,990) – (12,348/41,160))/(12,348/41,160)	33.3% increase
Electronic goods	((15,073/41,870) – (11,424/32,640))/(11,424/32,640)	2.9% increase
Cloud computing services	((8,160/12,400) – (4,940/6,520))/(4,940/6,520)	13.1% decrease
Change in total late deliveries	((1-0.74) – (1-0.92))/(1-0.92)	225.0% increase
Change in % of customers who complain	((1.4m/7.1m) – (0.32m/6.5m))/(0.32m/6.5m)	300% increase
Change in Gold member missed deliveries	(14 % – 2%)/2%	600% increase

Click the table to view larger version

15% increase in total revenue This is a good sign. It shows that Jungle Co is selling more units because 'prices are stable', and/or the new cloud service is expanding. But, we need a breakdown of revenue to understand this (see below).

32.7% increase in net margin This is excellent sign. It's linked to the lower cost of sales from Slabak imports and the launch of cloud computing, which is probably a higher-margin product (for example, no distribution costs for IT services).

60.5% increase in admin expenses This is a problem because admin costs are usually fixed. This is linked to the big increase in customer service costs, which, in turn, is probably related to the lower quality of the new supplier which is causing more complaints (see below).

5.3% drop in household goods revenue This is a worrying sign – it could be linked to the possible drop in quality from the Slabak imports.

28.3% change in electronic goods revenue This is another positive signal. It shows that Jungle is outperforming the average market growth of 20%, which means they are gaining market share.

225% increase in late deliveries This is a major problem. It's linked to the move to in-house logistics. Clearly Jungle Co can't match the quality of the external, international suppliers. Jungle Co needs to address this as it threatens future growth of the business.

300% increase in % of customers who complain This is another major problem. It's linked to both the outsourcing of production to Slabak, and the move to in-house logistics (mentioned above). Clearly Jungle Co has serious internal process problems that will negatively affect their reputation.

Overall We see mostly good news from the financial indicators: sales, margins, and profits are generally increasing. However, the non-financial information paints a different picture as we see serious problems emerging with Jungle Co's quality and logistics. Jungle Co needs to address these issues if they want their financial success to continue in the long term.

Summary

Common mistake	How to avoid
'Over calculating' and 'under writing'	Look for the time-management clue in the requirement – for example, if the requirement says, '1/3 of the marks are available for calculations', spend 1/3 of your time calculating and 2/3 writing
Not referencing the scenario in your discussion	Highlight the key points from the scenario as you read and then link to them in your discussion
Going no further than calculations	Highlight the verb and do what the verb says. If it's 'discuss', or 'evaluate', it's likely at least half of the marks will come from your writing, not your calculating
Double-checking all your calculations	Calculate quickly once, and move to the discussion. 'Own figure rule' will be in effect.
Only restating your calculation as words	Use the paragraph writing tool, 'calculate-comment-discuss'
Providing only short, generic, one-phrase comments	Use the paragraph writing tool, 'calculate-comment-discuss'
'Requirement drift' – answering an invented requirement, rather than the one given in the question.	Highlight the verb and only do what is asked. Nothing more.
Discussing change in absolute, rather than relative, terms.	Calculate changes in relative terms and discuss the impact of this. (For example, if missed deliveries go from 3% to 6%, what's important is that missed deliveries

	increased by 100%, or doubled, not that they increased three percentage points).
Producing a 'sea of words' – this is an unstructured essay with no signposting or breaks between ideas	Use short paragraphs, with headings and sub-headings. Use 1 paragraph per idea.
Running out of time	Follow the time management rule of 1.7 or 1.8 minutes per mark; remember you won't lose marks for spelling or grammar mistakes if you are understood by the marker

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Chapter 23 Building Blocks of Performance Measurement

Executive Summary

Fitzgerald and Moon's Building Block Model is an evolution of the Balanced Scorecard, developed to meet the needs of service organisations. It is a tool that helps management set a forward-looking performance management framework that links an organisation's strategy and objectives to employee targets and motivation.

The Building Block model looks at three areas of performance: dimensions, standards, and rewards.

Dimensions

- Financial performance
- Competitiveness
- Quality
- Innovation
- Flexibility
- Resource utilisation

Standards

- Ownership
- Achievability
- Equity

Rewards

- Clarity
- Controllability
- Motivation

Building Block model connects an organisation's strategic objectives to a range of forward-looking, non-financial performance measures. Where the Building Block Model differs, however, is that also considers reward systems and aims to create a framework of clearly understood and communicated individual metrics that aligns individual performance targets with organizational objectives.

Performance management—the processes that ensure organisations meet their objectives—is core to the F5 syllabus, and understanding modern performance measurement systems is an important area within this topic. F5 students should already be familiar with Kaplan & Norton's Balanced Scorecard which is a regularly examined topic and one of the foundations of modern performance measurement. **Fitzgerald and Moon's Building Block Model** is an evolution of the Balanced Scorecard, developed to meet the needs of service organisations. It is a tool that helps management set a forward-looking performance management framework that links an organisation's strategy and objectives to employee targets and motivation.

This article will review the importance of the modern approach to performance measurement, discuss the Building Block model, and apply this model to an exam-based scenario.

Measuring performance

An approach to measuring performance that we are familiar with is, 'looking at the numbers.' Classic questions which are often asked about a company are, 'How much profit has it made?' 'How much have sales grown?' 'What's its market share compared to the competition?' However, these traditional, financial performance metrics which are regularly calculated for accountancy exams are no longer sufficient, according to leading thinkers on strategy and performance management.

Profit-based performance metrics measure past performance. They are also distorted by accounting policies. Just look at the famous auto and engine maker Rolls Royce; its recently reported profits would be £900m lower under new IFRS revenue recognition requirements. Financial metrics are also criticised as leading to 'managerial myopia,' or short-termism, whereby management make decisions which sacrifice future performance for profits today. Managers can be motivated to postpone investments and other costs to maintain their quarterly or annual profits if their success is judged solely against financial performance targets.

Performance management experts argue that in the increasingly competitive modern business environment, organisations now need forward-looking performance measurement systems, linked to their critical success factors, to achieve long-term success. The new question to ask is, 'what areas of performance are critical to achieving our strategic objectives and how do we measure them?'

The following scenario will be used to discuss and illustrate the Building Block Model.

Scenario: SmartCourier

SmartCourier is a package delivery company located in the developing country of Maxland. Since its formation in 1970, SmartCourier has evolved into one of the largest and most

successful shipping companies in the country. Its mission is 'to exceed customers' expectations in the transfer of packages by offering the highest-quality services at competitive prices.'

SmartCourier offers a range of delivery services such as:

- Standard overnight delivery
- A premium add-on of guaranteed 10:30am delivery
- A cheaper, three-day service for less time-critical deliveries

SmartCourier has recently launched an app that lets customers set pickup times and locations on their smartphones which has received positive reviews in the technology press.

SmartCourier has identified the following critical success factors:

- Deliver sustainable profits to shareholders
- Leave customers highly satisfied at every interaction with SmartCourier
- Provide a range of products which meet our clients' evolving needs
- Lead the industry with constant innovation

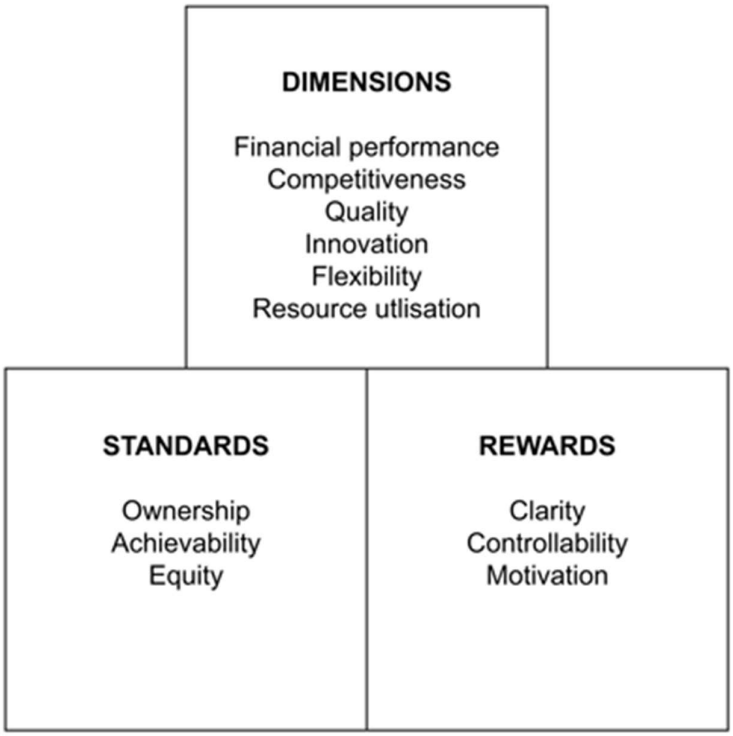
Managers at SmartCourier have a dynamic compensation package which includes share options, goal-based incentives, commissions, and non-monetary public recognition. SmartCourier also allows for flexible work schedules and is piloting an on-site child care programme at one of its locations.

SmartCourier receives positive coverage in the press about its work environment and is considered to be an attractive employer, with motivated employees and a good reputation among job seekers.

However, SmartCourier's profits have dropped in recent years due to increasing competition from global transport companies who have recently entered the market in Maxland.

The Building Block Model

The Building Block model looks at three areas of performance: dimensions, standards, and rewards.



Dimensions Explained

Companies compete across a range of dimensions besides financial performance. The Building Block model considers this and describes two categories of dimensions: 'Results' and 'Determinants.'

'Results' are the outcome of decisions and actions taken by management in the past. These are captured under the first two dimensions of the model, **financial performance** and **competitiveness**.

'Determinants' refer to the forward-looking dimensions of the model: what areas of future performance are most important for a company to achieve positive financial and competitive results? **Quality, innovation, flexibility** and **resource utilization** are the determinants of future success.

Dimensions at SmartCourier

Results As a listed company, the management of SmartCourier will be very interested in measuring **financial success**—is it delivering the right profits and returns for its shareholders? **Competitiveness** is also critical to measure as new competitors are entering the market in Maxland—is SmartCourier maintaining or losing market share?

Determinants SmartCourier's managers and staff need to focus on the dimensions of performance that will determine positive financial and competitive results. For example, on-

time deliveries will lead to customer loyalty. This falls under **quality** of service. The company's varied product range should meet the needs of different customer segments; this is an example of **flexibility** of service. Flexibility and quality of service should in turn drive positive **financial**results, for example, higher sales revenue.

Innovation is also important to SmartCourier as it is investing in new technology and improving processes with its smartphone app. **Resource utilisation** is critical to its financial success as efficient use of delivery vehicles, staff and financial resources will reduce costs and improve profitability. In other words, innovation and resource utilisation are driving financial success (higher profits) and competitiveness (maintaining market share).

Standards Explained

After an organisation's dimensions are understood, standards can be set. These will be the benchmarks, or targets, directly linked to performance metrics under headings for each dimension**.** There are three aspects to consider in setting standards:

- Who is responsible for achieving the standard (**ownership**)?
- What level are the standards set at (**achievability**)?
- Can we use the standards for a fair appraisal across the company (**equity**)?

These three criteria are important. If it is unclear to whom targets are assigned, managers and staff will not have accountability and performance management will fail. If personal targets are unachievable, people will not work harder to achieve their goals and there will be little motivation. If appraisal is not fair and transparent, employee morale will suffer.

Standards at SmartCourier

Based on the dimensions above, we can suggest standards of performance for SmartCourier:

Financial performance *Growth in sales, net profit margin,* and *return on investment* are potential targets for regional managers. For example, fixed targets could be set, such as *8% annual growth in sales* or a *target ROI of 14%.* Or, SmartCourier could use a league table approach by ranking the regions according to these standards and then rewarding managers accordingly.

Competitiveness With new players on the market it is important for SmartCourier to measure this area of external performance. It can set *absolute market share* as a standard for measuring competitiveness by dividing SmartCourier's revenue by the total revenue of the industry in Maxland. A target for regional managers could be to maintain market share as competitive rivalry is increasing in the industry.

Quality As a service organisation, it is critical that SmartCourier delivers quality of service to retain its customer base. It can set targets for courier agents such as 98*% on-time delivery*, or for call centre representatives *average time to take an order* of 3 minutes. It will be important to ensure that these targets are both fair and achievable to ensure employees are motivated (see below).

Resource utilisation SmartCourier can measure resource utilisation by using efficiency standards such as *average time per delivery* or *average number of deliveries per day.* However, equity should be considered here, as urban regions could potentially out-perform rural regions as urban customers will be clustered closer together.

Flexibility of service and innovation Flexibility of service can be measured with a targets such as 90*% of orders scheduled to customers' request* and Innovation can be measured with *% of customers using the smartphone app*.

Rewards Explained

The last part of the model looks at the overall reward structure of the organisation and is the link to HR systems. Do compensation packages in the company lead people to achieve the standards of performance which are set out above? This part of the model has three aspects:

- Is the system understandable to all employees (**clarity**)?
- Will the system drive employees to achieve their objectives (**motivation**)?
- Do employees have control over their areas of responsibility (**controllability**)?

The reward system should be clearly understood by all employees: this means unambiguous performance appraisal and bonus triggers. Rewards should be sufficiently desirable so that employees are motived to work hard towards gaining them. Finally, if employees are assessed against factors out of their control, they will lose interest in working towards their rewards.

Rewards at SmartCourier

It seems like SmartCourier has an effective reward system. The compensation package covers a range of financial and non-financial rewards and benefits, which probably contributes to the motivation of employees by meeting their different needs. For example, new parents will be motivated by the child care facilities, other staff may be motivated by the flexible work place arrangements. It also appears that rewards are performance based (for example, 'goal based incentives') which will lead to increased motivation.

It's important for SmartCourier to ensure that rewards are controllable and clear, for example, by making sure that targets are well defined and then agreed in appraisal meetings.

Conclusion

Like other modern performance measurement frameworks, the Building Block model connects an organisation's strategic objectives to a range of forward-looking, non-financial performance measures. Where the Building Block Model differs, however, is that also considers reward systems and aims to create a framework of clearly understood and communicated individual metrics that aligns individual performance targets with organizational objectives.

Steve Willis is head tutor for Management Accounting exams at PwC Academy

References (1) Philip Moon and Lin Fitzgerald, *Performance Measurement in Service Industries, Making It Work*, Chartered Institute of Management Accountants, 1996 (2) Philip Moon and Lin Fitzgerald, *Delivering the Goods at TNT: the Role of a Performance Measurement System*, Management Accounting Research 1996

Questions

Which of the following statements regarding Fitzgerald and Moon's Building Blocks model are correct?
(1) The determinants of performance are quality, innovation, resource utilisation and competitiveness
(2) Standards are targets for performance and should be fair, achievable and controllable
(3) Rewards encourage staff to work towards the standards and should be clear, motivating and controllable
(4) It is a performance measurement framework particularly suitable for service organisations

A (1), (2) and (3)
B (2) and (3) only
C (3) and (4)
D (1), (2) and (4)

Answer: C

The determinants of performance are quality, innovation, resource utilisation and flexibility. Competitiveness is a result of the determinants.

Standards should be fair, achievable and staff should have ownership of them. Controllability is a feature of the rewards block.

Rewards should be clear, motivating and controllable, so this is correct.

It is a framework designed to attempt to overcome the problems associated with performance management in service companies.

Chapter 24 Transfer Pricing

Executive Summary

Why transfer pricing is important

- they encourage divisions to trade in a way that maximises profits for the company as a whole
- they also need to be set in a way that is compliant with tax laws, allows for performance evaluation

Market price available

Spare capacity

- where a selling division has spare capacity the minimum transfer price is effectively just marginal cost.

No spare capacity

- In situations where there is no spare capacity, the minimum transfer price is such that the selling division would make just as much profit from selling internally as selling externally.

The maximum price that the buying division will want to pay is the market price for the product

No external market for the product being transferred

- Variable cost
- Full cost
- Full cost plus
- Variable cost plus

There is no doubt that transfer pricing is an area that candidates find difficult. It's not surprising, then, that when it was examined in June 2014's Performance Management exam, answers were not always very good.

The purpose of this article is to strip transfer pricing back to the basics and consider, first, why transfer pricing is important; secondly, the general principles that should be applied when setting a transfer price; and thirdly, an approach to tackle exam questions in this area, specifically the question from June 2014's exam. We will talk about transfer pricing here in terms of two divisions trading with each other. However, don't forget that these principles apply equally to two companies within the same group trading with each other.

This article assumes that transfer prices will be negotiated between the two parties. It does not look at alternative methods such as dual pricing, for example. This is because, in Performance Management, the primary focus is on working out a sensible transfer price or range of transfer prices, rather than different techniques to setting transfer prices.

Why transfer pricing is important

It is essential to understand that transfer prices are only important in so far as they encourage divisions to trade in a way that maximises profits for the company as a whole. The fact is that the effects of inter-divisional trading are wiped out on consolidation anyway. Hence, all that really matters is the total value of external sales compared to the total costs of the company. So, while getting transfer prices right is important, the actual transfer price itself doesn't matter since the selling division's sales (a credit in the company accounts) will be cancelled out by the buying division's purchases (a debit in the company accounts) and both figures will disappear altogether. All that will be left will be the profit, which is merely the external selling price less any cost incurred by **both** divisions in producing the goods, irrespective of which division they were incurred in.

As well as transfer prices needing to be set at a level that maximises company profits, they also need to be set in a way that is compliant with tax laws, allows for performance evaluation of both divisions and staff/managers, and is fair and therefore motivational. A little more detail is given on each of these points below:

- If your company is based in more than one country and it has divisions in different countries that are trading with each other, the price that one division charges the other will affect the profit that each of those divisions makes. In turn, given that tax is based on profits, a division will pay more or less tax depending on the transfer prices that have been set. While you don't need to worry about the detail of this for the Performance Management exam, it's such an important point that it's simply impossible not to mention it when discussing why transfer pricing is important.
- From bullet point 1, you can see that the transfer price set affects the profit that a division makes. In turn, the profit that a division makes is often a key figure used when assessing the performance of a division. This will certainly be the case if return on investment (ROI) or residual income (RI) is used to measure performance. Consequently, a division may, for

example, be told by head office that it has to buy components from another division, even though that division charges a higher price than an external company. This will lead to lower profits and make the buying division's performance look poorer than it would otherwise be. The selling division, on the other hand, will appear to be performing better. This may lead to poor decisions being made by the company.

- If this is the case, the manager and staff of that division are going to become unhappy. Often, their pay will be linked to the performance of the division. If divisional performance is poor because of something that the manager and staff cannot control, and they are consequently paid a smaller bonus for example, they are going to become frustrated and lack the motivation required to do the job well. This will then have a knock-on effect to the real performance of the division. As well as being seen not to do well because of the impact of high transfer prices on ROI and RI, the division really will perform less well.

The impact of transfer prices could be considered further but these points are sufficient for the level of understanding needed for the Performance Management exam. Let us now go on to consider the general principles that you should understand about transfer pricing. Again, more detail could be given here and these are, to some extent, oversimplified. However, this level of detail is sufficient for the Performance Management exam.

General principles about transfer pricing

1. Where there is an external market for the product being transferred Minimum transfer price When we consider the minimum transfer price, we look at transfer pricing from the point of view of the selling division. The question we ask is: what is the minimum selling price that the selling division would be prepared to sell for? This will not necessarily be the same as the price that the selling division would be happy to sell for, although, as you will see, if it does not have spare capacity, it is the same.

The minimum transfer price that should ever be set if the selling division is to be happy is: marginal cost + opportunity cost.

Opportunity cost is defined as the 'value of the best alternative that is foregone when a particular course of action is undertaken'. Given that there will only be an opportunity cost if the seller does not have any spare capacity, the first question to ask is therefore: does the seller have spare capacity?

Spare capacity If there is spare capacity, then, for any sales that are made by using that spare capacity, the opportunity cost is zero. This is because workers and machines are not fully utilised. So, where a selling division has spare capacity the minimum transfer price is effectively just marginal cost. However, this minimum transfer price is probably not going to be one that will make the managers happy as they will want to earn additional profits. So, you would expect them to try and negotiate a higher price that incorporates an element of profit.

No spare capacity If the seller doesn't have any spare capacity, or it doesn't have enough spare capacity to meet all external demand and internal demand, then the next question to consider is: how can the opportunity cost be calculated? Given that opportunity cost represents contribution foregone, it will be the amount required in order to put the selling division in the same position as they would have been in had they sold outside of the group. Rather than specifically working an 'opportunity cost' figure out, it's easier just to stand back and take a logical approach rather than a rule-based one.

Logically, the buying division must be charged the same price as the external buyer would pay, less any reduction for cost savings that result from supplying internally. These reductions might reflect, for example, packaging and delivery costs that are not incurred if the product is supplied internally to another division. It is not really necessary to start breaking the transfer price down into marginal cost and opportunity cost in this situation.

It's sufficient merely to establish:

(i) what price the product could have been sold for outside the group (ii) establish any cost savings, and (iii) deduct (ii) from (i) to arrive at the minimum transfer price.

At this point, we could start distinguishing between perfect and imperfect markets, but this is not necessary in Performance Management. There will be enough information given in a question for you to work out what the external price is without focusing on the market structure.

We have assumed here that production constraints will result in fewer sales of the same product to external customers. This may not be the case; perhaps, instead, production would have to be moved away from producing a different product. If this is the case the opportunity cost, being the contribution foregone, is simply the shadow price of the scarce resource.

In situations where there is no spare capacity, the minimum transfer price is such that the selling division would make just as much profit from selling internally as selling externally. Therefore, it reflects the price that they would actually be happy to sell at. They shouldn't expect to make higher profits on internal sales than on external sales.

Maximum transfer price When we consider the maximum transfer price, we are looking at transfer pricing from the point of view of the buying division. The question we are asking is: what is the maximum price that the buying division would be prepared to pay for the product? The answer to this question is very simple and the maximum price will be one that the buying division is also happy to pay.

The maximum price that the buying division will want to pay is the market price for the product – ie whatever they would have to pay an external supplier for it. If this is the same as the selling division sells the product externally for, the buyer might reasonably expect a reduction to reflect costs saved by trading internally. This would be negotiated by the divisions and is called an adjusted market price.

2. Where there is no external market for the product being transferred Sometimes, there will be no external market at all for the product being supplied by the selling division; perhaps it is a particular type of component being made for a specific company product. In this situation, it is not really appropriate to adopt the approach above. In reality, in such a situation, the selling division may well just be a cost centre, with its performance being judged on the basis of cost variances. This is because the division cannot really be judged on its commercial performance, so it doesn't make much sense to make it a profit centre. Options here are to use a cost based approach to transfer pricing but these also have their advantages and disadvantages.

Cost based approaches

	Division A	Division B
	$	$
Transfer in price	-	30
Own costs - variable	18	10
- fixed	12	10
Divisional profit/mark-up	0	40
Transfer out/final sales price	30	90

Variable cost A transfer price set equal to the variable cost of the transferring division produces very good economic decisions. If the transfer price is $18, Division B's marginal costs would be $28 (each unit costs $18 to buy in then incurs another $10 of variable cost). The group's marginal costs are also $28, so there will be goal congruence between Division B's wish to maximise its profits and the group maximising its profits. If marginal revenue exceeds marginal costs for Division B, it will also do so for the group.

Although good economic decisions are likely to result, a transfer price equal to marginal cost has certain drawbacks:

Division A will make a loss as its fixed costs cannot be covered. This is demotivating.

Performance measurement is also distorted. Division A is condemned to making losses while Division B gets an easy ride as it is not charged enough to cover all costs of manufacture. This effect can also distort investment decisions made in each division. For example, Division B will enjoy inflated cash inflows.

There is little incentive for Division A to be efficient if all marginal costs are covered by the transfer price. Inefficiencies in Division A will be passed up to Division B. Therefore, if marginal cost is going to be used as a transfer price, it at least should be standard marginal cost, so that efficiencies and inefficiencies stay within the divisions responsible for them.

Full cost/Full cost plus/Variable cost plus A transfer price set at full cost or better, full standard cost is slightly more satisfactory for Division A as it means that it can aim to break even. Its big drawback, however, is that it can lead to dysfunctional decisions because Division B can make decisions that maximise its profits but which will not maximise group profits. For example, if the final market price fell to $35, Division B would not trade because its marginal cost would be $40 (transfer-in price of $30 plus own marginal costs of $10). However, from a group perspective, the marginal cost is only $28 ($18 + $10) and a positive contribution would be made even at a selling price of only $35. Head office could, of course, instruct Division B to trade but then divisional autonomy is compromised and Division B managers will resent being instructed to make negative contributions which will impact on their reported performance. Imagine you are Division B's manager, trying your best to hit profit targets, make wise decisions, and move your division forward by carefully evaluated capital investment.

The full cost *plus* approach would increase the transfer price by adding a mark-up. This would now motivate Division A, as profits can be made there and may also allow profits to be made by Division B. However, again this can lead to dysfunctional decisions as the final selling price falls.

The difficulty with full cost, full cost plus and variable cost plus is that they all result in fixed costs and profits being perceived as marginal costs as goods are transferred to Division B. Division B therefore has the wrong data to enable it to make good economic decisions for the group – even if it wanted to. In fact, once you get away from a transfer price equal to the variable cost in the transferring division, there is always the risk of dysfunctional decisions being made unless an upper limit – equal to the net marginal revenue in the receiving division – is also imposed.

Tackling a transfer pricing question

Thus far, we have only talked in terms of principles and, while it is important to understand these, it is equally as important to be able to apply them. The following question came up in June 2014's exam. It was actually a 20-mark question with the first 10 marks in part (a) examining divisional performance measurement and the second 10 marks in part (b) examining transfer pricing. Parts of the question that were only relevant to part (a) have been omitted here however the full question can be found on ACCA's website. The question read as follows:

Reproduction of exam question

Relevant extracts from part (a) The Rotech group comprises two companies, W Co and C Co.

W Co is a trading company with two divisions: the design division, which designs wind turbines and supplies the designs to customers under licences and the Gearbox division, which manufactures gearboxes for the car industry.

C Co manufactures components for gearboxes. It sells the components globally and also supplies W Co with components for its Gearbox manufacturing division.

The financial results for the two companies for the year ended 31 May 2014 are as follows:

	A	B	C	D	E	F
1			W Co		C Co	
2			Design division	Gearbox division		
3			$'000	$'000	$'000	
4	External sales		14,300	25,535	8,010	
5	Sales to Gearbox					
6	division				7,550	
7					15,560	
8	Cost of sales		(4,900)	*(16,200)	(5,280)	
9	Administration costs		(3,400)	(4,200)	(2,600)	
10	Distribution costs		-	(1,260)	(670)	
11						
12	Operating profit		6,000	3,875	7,010	
13						
14	*Includes cost of components purchased from C Co.					

(b) C Co is currently working to full capacity. The Rotech group's policy is that group companies and divisions must always make internal sales first before selling outside of the group. Similarly, purchases must be made from within the group wherever possible. However, the group divisions and companies are allowed to negotiate their own transfer prices without interference from head office.

C Co has always charged the same price to the Gearbox division as it does to its external customers. However, after being offered a 5% lower price for the similar components from an external supplier, the manager of the Gearbox division feels strongly that the transfer price is too high and should be reduced. C Co currently satisfies 60% of the external demand for its components. Its variable costs represent 40% of the total revenue for the internal sales of the components.

Required:

Advise, using suitable calculations, the total transfer price or prices at which the components should be supplied to the Gearbox division from C Co. ***(10 marks)***

Approach

1. As always, you should begin by reading the requirement. In this case, it is very specific as it asks you to 'advise, using suitable calculations…' In a question like this, it would actually be impossible to 'advise' without using calculations anyway and your answer would score very few marks. However, this wording has been added in to provide assistance. In transfer

pricing questions, you will sometimes be asked to calculate a transfer price/range of transfer prices for one unit of a product. However, in this case, you are being asked to calculate the total transfer price for the internal sales. You don't have enough information to work out a price per unit.

2. Allocate your time. Given that this is a 10-mark question then, since it is a three-hour exam, the total time that should be spent on this question is 18 minutes.

3. Work through the scenario, highlighting or underlining key points as you go through. When tackling part (a) you would already have noted that C Co makes $7.55m of sales to the Gearbox Division (and you should have noted who the buying division was and who the selling division was). Then, in part (b), the first sentence tells you that C Co is currently working to full capacity. Highlight this; it's a key point, as you should be able to tell now. Next, you are told that the two divisions must trade with each other before trading outside the group. Again, this is a key point as it tells you that, unless the company is considering changing this policy, C Co is going to meet all of the Gearbox division's needs. Next, you are told that the divisions can negotiate their own transfer prices, so you know that the price(s) you should suggest will be based purely on negotiation. Finally, you are given information to help you to work out maximum and minimum transfer prices. You are told that the Gearbox division can buy the components from an external supplier for 5% cheaper than C Co sells them for. Therefore, you can work out the maximum price that the division will want to pay for the components. Then, you are given information about the marginal cost of making gearboxes, the level of external demand for them and the price they can be sold for to external customers. You have to work all of these figures out but the calculations are quite basic. These figures will enable you to calculate the minimum prices that C Co will want to sell its gearboxes for; there are two separate prices as, when you work the figures through, it becomes clear that, if C Co sold purely to the external market, it would still have some spare capacity to sell to the Gearbox division. So, the opportunity cost for some of the sales is zero, but not for the other portion of them.

4. Having actively read through the scenario, you are now ready to begin writing your answer. You should work through in a logical order. Consider the transfer from both C Co's perspective (the minimum transfer price), then Gearbox division's perspective (the maximum transfer price), although it doesn't matter which one you deal with first. Head up your paragraphs so that your answer does not simply become a sea of words. Also, by heading up each one separately, it helps you to remain focused on fully discussing that perspective first. Finally, consider the overall position, which in this case is to suggest a sensible range of transfer prices for the sale. There is no single definitive answer but, as is often the case, a range of prices that would be acceptable.

The suggested solution is shown below.

Always remember that you should only show calculations that actually have some relevance to the answer. In this exam, many candidates actually worked out figures that were of no relevance to anything. Such calculations did not score marks.

Reproduction of answer

***From C Co's perspective**:* C Co transfers components to the Gearbox division at the same price as it sells components to the external market. However, if C Co were not making internal sales then, given that it already satisfies 60% of external demand, it would not be able to sell all of its current production to the external market. External sales are $8,010,000, therefore unsatisfied external demand is ([$8,010,000/0.6] – $8,010,000) = $5,340,000.

From C Co's perspective, of the current internal sales of $7,550,000, $5,340,000 could be sold externally if they were not sold to the Gearbox division. Therefore, in order for C Co not to be any worse off from selling internally, these sales should be made at the current price of $5,340,000, less any reduction in costs that C Co saves from not having to sell outside the group (perhaps lower administrative and distribution costs).

As regards the remaining internal sales of $2,210,000 ($7,550,000 – $5,340,000), C Co effectively has spare capacity to meet these sales. Therefore, the minimum transfer price should be the marginal cost of producing these goods. Given that variable costs represent 40% of revenue, this means that the marginal cost for these sales is $884,000. This is, therefore, the minimum price which C Co should charge for these sales.

In total, therefore, C Co will want to charge at least $6,224,000 for its sales to the Gearbox division.

From the Gearbox division's perspective: The Gearbox division will not want to pay more for the components than it could purchase them for externally. Given that it can purchase them all for 95% of the current price, this means a maximum purchase price of $7,172,500.

Overall: Taking into account all of the above, the transfer price for the sales should be somewhere between $6,224,000 and $7,172,500.

Summary

The level of detail given in this article reflects the level of knowledge required for Performance Management as regards transfer pricing questions of this nature. It's important to understand why transfer pricing both does and doesn't matter and it is important to be able to work out a reasonable transfer price/range of transfer prices.

The thing to remember is that transfer pricing is actually mostly about common sense. You don't really need to learn any of the specific principles if you understand what it is trying to achieve: the trading of divisions with each other for the benefit of the company as a whole. If the scenario in a question was different, you may have to consider how transfer prices should be set to optimise the profits of the group overall. Here, it was not an issue as group policy was that the two divisions had to trade with each other, so whether this was actually the best thing for the company was not called into question. In some questions, however it could be, so bear in mind that this would be a slightly different requirement. Always read the requirement carefully to see exactly what you are being asked to do.

Written by a member of the Performance Management examining team

Questions

Which of the following statements about transfer pricing is correct?
A Head office managers should never be involved in transfer pricing decisions
B The market price will always be the most appropriate transfer price
C The transfer price will not affect divisional profits
D The transfer price should promote goal congruence

Answer: D

A is not correct – it may be desirable to leave divisional managers to negotiate alone, but there will often be situations where head office managers will need to become involved to ensure that negotiations run smoothly.

B – the market price may be the most appropriate transfer price if the selling division is operating at full capacity. This will not always be the case however, and if the selling division has spare capacity, using the market price may lead to goal incongruence.

Chapter 25 Not-For-Profit Organisations – Part 1

Executive Summary

Not-for-profit organisations are distinguished from profit maximising organisations by three characteristics

1. do not have external shareholders
2. do not distribute dividends
3. their objectives usually include some social, cultural, philanthropic, welfare or environmental dimension

Public sector organisations do not have profit as their primary objective and were established in order to provide what economists refer to as public goods.

Private sector examples include most forms of charity and self-help organisations.

It is important to recognise that although not-for-profit organisations do not maximise profit as a primary objective, many are expected to be self financing and, therefore, generate profit in order to survive and grow.

Most not for-profit organisations rely on measures that estimate the performance of the organisation in relation to:

1. **Effectiveness**
2. **Economy**
3. **Efficiency**

Value for money

Several exams in the ACCA Qualification may feature questions on not-for-profit organisations. Although many of the principles of management and organisation apply to most business models, not-for-profit organisations have numerous features that distinguish them from the profit maximising organisations often assumed in conventional economic theory.

This article explains some of these features. The first part of the article broadly describes the generic characteristics of not-for-profit organisations.

The second part of the article takes a specific and deeper look at charities, which are one of the more important types of not-for-profit organisations.

What is a not-for-profit organisation?

It would be simplistic to assume that any organisation that does not pursue profit as an objective is a not-for-profit organisation. This is an incorrect assumption, as many such organisations do make a profit every year and overtly include this in their formal plans. Quite often, they will describe their profit as a 'surplus' rather than a profit, but as either term can be defined as an excess of income over expenditure, the difference may be considered rather semantic.

Not-for-profit organisations are distinguished from profit maximising organisations by three characteristics. First, most not-for-profit organisations do not have external shareholders providing risk capital for the business. Second, and building on the first point, they do not distribute dividends, so any profit (or surplus) that is generated is retained by the business as a further source of capital. Third, their objectives usually include some social, cultural, philanthropic, welfare or environmental dimension, which in their absence, would not be readily provided efficiently through the workings of the market system.

Types of not-for-profit organisation

Not-for-profit organisations exist in both the public sector and the private sector. Most, but not all, public sector organisations do not have profit as their primary objective and were established in order to provide what economists refer to as public goods. These are mainly services that would not be available at the right price to those who need to use them (such as medical care, museums, art galleries and some forms of transportation), or could not be provided at all through the market (such as defence and regulation of markets and businesses). Private sector examples include most forms of charity and self-help organisations, such as housing associations that provide housing for low income and minority groups, sports associations (many football supporters' trusts are set up as industrial and provident societies), scientific research foundations and environmental groups.

Corporate form

Not-for-profit organisations can be established as incorporated or unincorporated bodies. The common business forms include the following:

- in the public sector, they may be departments or agents of government
- some public sector bodies are established as private companies limited by guarantee, including the Financial Services Authority (the UK financial services regulator)
- in the private sector they may be established as cooperatives, industrial or provident societies (a specific type of mutual organisation, owned by its members), by trust, as limited companies or simply as clubs or associations.

A cooperative is a body owned by its members, and usually governed on the basis of 'one member, one vote'. A trust is an entity specifically constituted to achieve certain objectives. The trustees are appointed by the founders to manage the funds and ensure compliance with the objectives of the trust. Many private foundations (charities that do not solicit funds from the general public) are set up as trusts.

Formation, constitution and objectives

Not-for-profit organisations are invariably set up with a purpose or set of purposes in mind, and the organisation will be expected to pursue such objectives beyond the lifetime of the founders. On establishment, the founders will decide on the type of organisation and put in place a constitution that will reflect their goals. The constitutional base of the organisation will be dictated by its legal form.

If it is a company, it will have a Memorandum and Articles of Association, with the contents of the latter entrenched to ensure that the objectives cannot be altered easily in the future. Not-for-profit organisations that are not companies most commonly have a set of Rules, which are broadly equivalent to Articles of Association.

As with any type of organisation, the objectives of not-for-profit organisations are laid down by the founders and their successors in management.

Unlike profit maximisers, however, the broad strategic objectives of not-for-profit organisations will tend not to change over time.

The purposes of the latter are most often dictated by the underlying founding principles. Within these broad objectives, however, the focus of activity may change quite markedly. For example, during the 1990s the British Know-How Fund, which was established by the UK government to provide development aid, switched its focus away from the emerging central European nations in favour of African nations.

It is important to recognise that although not-for-profit organisations do not maximise profit as a primary objective, many are expected to be self-financing and, therefore, generate profit in order to survive and grow. Even if their activities rely to some extent on external grants or subventions, the providers of this finance invariably expect the organisation to be as financially self-reliant as possible.

As the performance of not-for-profit organisations cannot be properly assessed by conventional accounting ratios, such as ROCE, ROI, etc, it often has to be assessed with reference to other measures. Most not-for-profit organisations rely on measures that estimate the performance of the organisation in relation to:

- effectiveness – the extent to which the organisation achieves its objectives
- economy – the ability of the organisation to optimise the use of its productive resources (often assessed in relation to cost containment)
- efficiency – the 'output' of the organisation per unit of resource consumed.

Many service-orientated organisations use 'value for money' indicators that can be used to assess performance against objectives. Where the organisation has public accountability, performance measures can also be published to demonstrate that funds have been used in the most cost-effective manner. It is important within an exam question to read the clues given by the examiner regarding what is important to the organisation and what are its guiding principles, and to use these when assessing the performance of the organisation.

Management

The management structure of not-for-profit organisations resembles that of profit maximisers, though the terms used to describe certain bodies and officers may differ somewhat.

While limited companies have a board of directors comprising executive and non-executive directors, many not-for-profit organisations are managed by a Council or Board of Management whose role is to ensure adherence to the founding objectives. In recent times there has been some convergence between how companies and not-for-profit organisations are managed, including increasing reliance on non-executive officers (notably in respect of the scrutiny or oversight role) and the employment of 'career' executives to run the business on a daily basis.

Written by a member of the Accountant in Business examining team

Chapter 26 Not-For-Profit Organisations – Part 2

Executive Summary

The term ‘charity’ refers to the practice of benevolent giving. Charities are established for general or specific philanthropic purposes.

A charity is not forbidden from engaging in commercial activities provided that these activities fully serve the objectives of the charity.

Most charities are managed by a Council, made up entirely of volunteers. These are broadly equivalent to non-executive directors in limited companies. It is the responsibility of the Council to chart the medium to long-term strategy of the charity and to ensure that objectives are met.

The term ‘charity’ refers to the practice of benevolent giving. Charities are established for general or specific philanthropic purposes.

They are one type of not-for-profit organisation, but with several additional distinguishing features:

- they exist entirely to benefit defined groups in society
- as their purposes are philanthropic, they can usually avail themselves of favourable tax treatment, and for this reason have to be registered with a regulator
- their activities are restricted or limited by a regulator
- they rely on the financial support of the public or businesses (or both) in order to achieve their objectives
- in order to be financially viable, they rely heavily on voluntary (unpaid) managers and workers.

Charitable activities

In the UK, charities are regulated by the Charities Act 2006, which sets out in very broad terms what may be considered to be charitable activities, many of which would be considered as such in other jurisdictions within most other countries. These include:

- the prevention or relief of poverty
- the advancement of education
- the advancement of religion
- the advancement of health or the saving of lives
- the advancement of citizenship or community development
- the advancement of the arts, culture, heritage or science
- the advancement of amateur sport
- the advancement of human
- rights, conflict resolution or reconciliation or the promotion of religious or racial harmony or equality and diversity
- the advancement of environmental protection or improvement
- the relief of those in need, by reason of youth, age, ill-health, disability, financial hardship or other disadvantage
- the advancement of animal welfare

- the promotion of the efficiency of the armed forces of the Crown or of the police, fire and rescue services or ambulance services
- other purposes currently recognised as charitable and any new charitable purposes which are similar to another charitable purpose.

The activities of charities in England and Wales are regulated by the Charity Commission, itself a not-for-profit organisation, located in Liverpool. The precise definition of what constitutes charitable activities differs, of course, from country to country. However, most of the activities listed above would be considered as charitable, as they would seldom be associated with commercial organisations.

Corporate form

Charities differ widely in respect of their size, objectives and activities. For example, Oxfam is a federal international organisation comprising 13 different bodies across all continents, while many thousands of charities are local organisations managed and staffed entirely by volunteers. Unsurprisingly, most of the constituent organisations within Oxfam operate as limited companies, while local charities would find this form inappropriate and prefer to be established as associations.

A charity is not forbidden from engaging in commercial activities provided that these activities fully serve the objectives of the charity. For example, charities such as the British Heart Foundation, the British Red Cross, and Age Concern all raise funds by operating chains of retail shops. These shops are profitable businesses, but if a company is formed to operate the shops, the company would be expected to formally covenant its entire annual profits to the charity.

Charities with high value non-current assets, such as real estate, usually vest the ownership of such assets to independent guardian trustees, whose role is to ensure that the assets are deployed in a manner that reflects the objectives of the charity.

The guardian trustees are empowered to lease land, subject to the provisions of the lease satisfying requirements laid down by the Charity Commission.

Formation, constitution and objectives

Charities are always formed with specific philanthropic purposes in mind. These purposes may be expanded or varied over time, provided the underlying purpose remains. For example, Oxfam was originally formed as the Oxford Committee for Famine Relief in 1942, and its original purpose was to relieve the famine in Greece brought about by the Allied blockade. Oxfam now provides famine relief on a worldwide basis.

The governing constitution of a charity is normally set down in its rules, which expand on the purposes of the business. Quite often, the constitution dictates what the organisation

cannot do, as well as what it can do. Charities plan and control their activities with reference to measures of effectiveness, economy and efficiency. They often publish their performance outcomes in order to convince the giving public that the good causes that they support ultimately benefit from charitable activities.

Management

Most charities are managed by a Council, made up entirely of volunteers. These are broadly equivalent to non-executive directors in limited companies. It is the responsibility of the Council to chart the medium to long-term strategy of the charity and to ensure that objectives are met.

Objectives may change over time due to changes in the external environment in which the charity operates. Barnardos is a childrens' charity that was originally founded as Doctor Barnado's Homes, to provide for orphans who could not rely on family support. The development of welfare services after World War II and the increasing willingness of families to adopt and foster children resulted in less reliance on the provision of residential homes for children but greater reliance on other support services. As a result, the Barnardos charity had to change the way in which it looked at maximising the welfare of orphaned children.

Local charities are dependent on the support of a more limited population and therefore have to consider whether their supporters will continue to provide the finance necessary to operate continuously. For example, a local charity supporting disabled sports could be profoundly affected by the development of facilities funded by central or local government.

Every charity is confronted by distinctive strategic and operational risks, of which the Council must take account in developing and implementing its plans. International aid charities are vulnerable to country risk and currency risk, so plans have to take account of local conditions in countries whose populations they serve. Many such countries may, of course, be inherently unstable politically. Operational risk for charities arises from the high dependence on volunteer workers, including the extent to which they can rely on continued support, as well as problems of internal control.

For example, many charities staff their shops with the help of unpaid retired people, but there is some debate as to whether future generations of retired people will be as willing to do this for nothing. As many charities have to contain operating expenses in order to ensure that their objectives can be met, it is often difficult or impossible for them to employ full-time or part-time paid staff to replace volunteer workers. Risks also arise from the social environment, particularly in times of recession, when members of the public may be less disposed to give to benefit others as their discretionary household income is reduced. There is some evidence of 'charity fatigue' in the UK. This arises when the public feel pressurised by so many different competing charities that they feel ill disposed to give anything to anyone at all.

Written by a member of the Accountant in Business examining team

Questions

A hospital management team assess performance using value for money. The following performance measures are reported by surgical departments:
(1) The number of patients who need to be re-admitted following surgery
(2) The staff cost of each surgical procedure

Which element of value for money is assessed by each measure?

	(1)	(2)
A	Economy	Efficiency
B	Efficiency	Effectiveness
C	Effectiveness	Efficiency
D	Effectiveness	Economy

Answer: D

Number of patients that need to be re admitted following surgery is a measure of how good the surgery was (i.e. the effectiveness). Staff cost of each procedure is a measure of economy.