CIMA
Operational Level – Paper P1
PERFORMANCE OPERATIONS
(REVISION SUMMARIES)

P1 revision summaries

Classification of costs and mathematics for budgets

Financial Accounting **(External information)**	Financial accounts are produced mainly for external users e.g. shareholders or investors.
Management Accounting **(Internal information)**	Management accounts are produced for internal users of financial information within an organisation e.g. directors and management.

Types and classification of costs

- **A direct cost or variable cost** is a cost that can be easily identified or related to a cost per unit or activity level.

Cost (£)

Direct or variable cost

Output or activity level (units)

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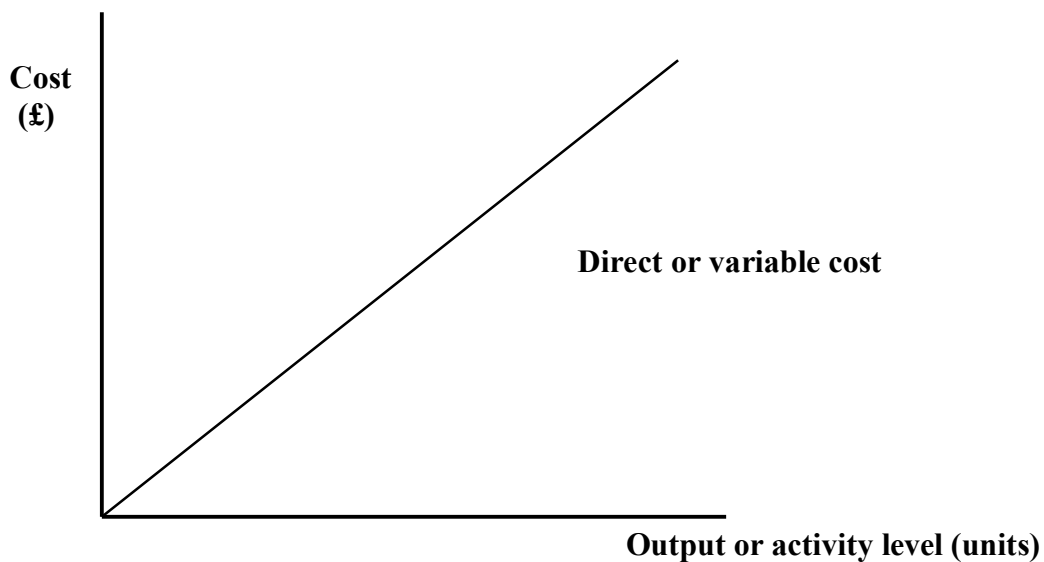
- **Indirect overhead or fixed cost** is a cost which cannot be easily identified or related to a cost per unit or activity level. Examples include a factory supervisor's salary or factory rent and rates.

Cost (£)

Indirect overhead or fixed cost

Output or activity level (units)
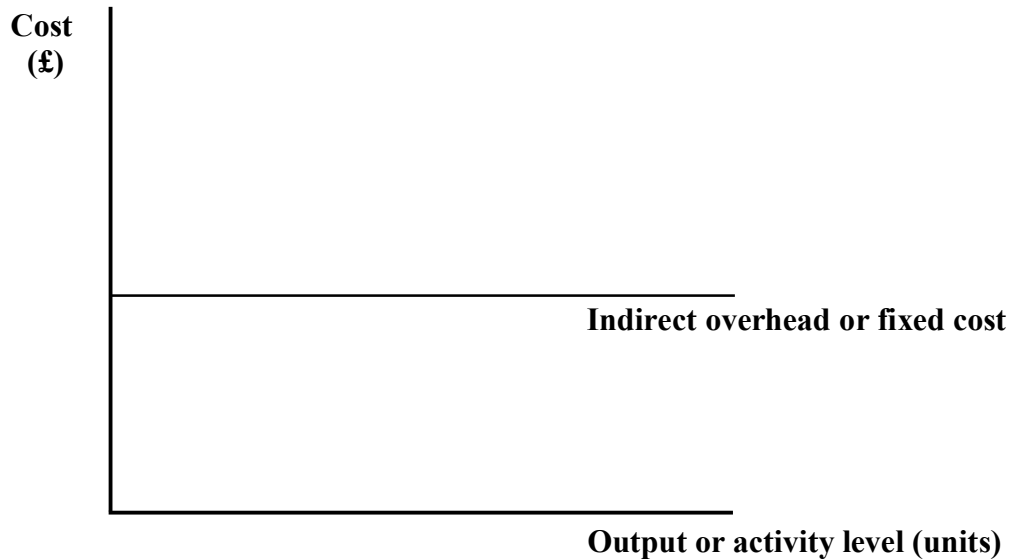
- **Semi-variable cost** is a cost containing both fixed and variable components and thus partly affected by a change in the level of activity.

- **Stepped fixed costs** are fixed costs that remain constant but only within a certain range of production. Once this range of production is exceeded the fixed cost will rise.

Example - Semi-variable cost

Cost (£)

Activity level
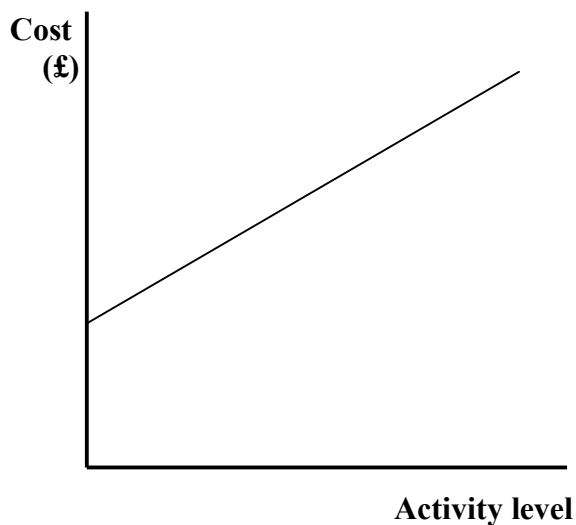
Example - Stepped fixed cost

Cost (£)

Activity level

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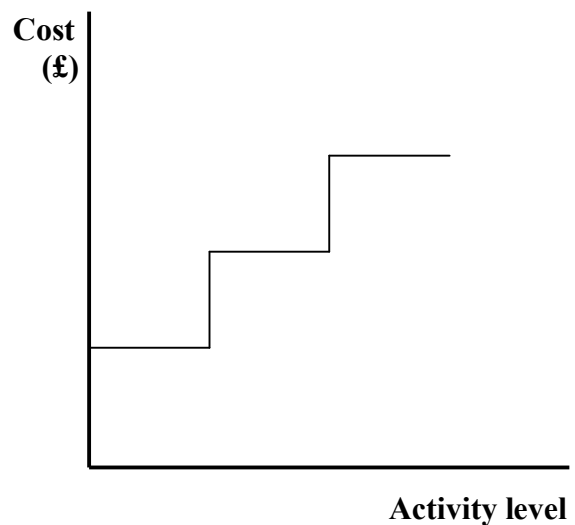
Forecasting techniques

Forecasting methods budget, forecast or project by extending historical data into the future, the various techniques include.

- High-low technique
- The 'line of best fit' using human judgement
- Regression analysis (or 'least squares method')
- Time series

The linear relationship for sales or cost forecasting, normally expressed as $Y = a + bX$

High-low technique

The high-low technique uses the highest and lowest level of activity given and the associated costs, to separately identify the variable and fixed cost components.

The 'line of best fit' using human judgement

A scatter-graph is a graphical method of creating a forecasting model by using the 'line of best fit' drawn free hand that closely matches or approximates to a series of data that has been plotted on the graph.

Production expenses

- **Direct material** e.g. the direct raw material
- **Direct labour** e.g. the labour physically engaged in making the product such as factory staff wages.
- **Variable production overhead** e.g. direct factory expenses other than material or labour such as hiring production equipment.
- **Prime cost** = total direct material + total direct labour + total variable production overhead
- **Fixed production overhead** e.g. production overhead incurred not easily attributed or ascertained to a cost object or cost unit e.g. factory supervisor salaries.

Non-production overhead

- Those costs which are not directly relate to the making of the product but support this process. For example administration overhead, selling overhead and distribution overhead.

A period cost is a cost deducted as an expense during an accounting period; it is a cost relating to time rather than the manufacturing or brought in cost of a product.

A product cost is the cost of making a finished product or the cost of purchasing a product for resale.

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Advanced mathematics for budgets

Regression analysis (or ‑method of least squaresø) uses a formulae (provided in the exam) in order to calculate a more scientific ‑line of best fitø It is therefore harder to understand, however far more accurate. It creates a model (Y = a + bX) that can be used as a forecasting technique.

Formulae provided in your exam

Y = a + bX

$$b = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

$$a = \overline{Y} - b\overline{X}$$

Correlation coefficient measures the strength of the relationship between X and Y, always giving a value between the range between -1 and +1, indicating how perfect your relationship is between X and Y and also whether the relationship is a positive or negative one.

$$\text{Correlation coefficient (r)} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{((n\sum X^2 - (\sum X)^2)(n\sum Y^2 - (\sum Y)^2))}}$$

Coefficient of determination measures how much a particular variable is determined or explained by another. To calculate this you simply square the correlation coefficient therefore obtaining r^2. It will provide you with a percentage and the higher the percentage the more determined or explained a variable is by another.

Time series

A time series is historical values recorded over time, such as total cost against output or monthly sales against time.

Two models for forecasting

Additive model   **TS = T + (+/-) SV**

Multiplicative model   **TS = T x SV (as a decimal or index value)**

Trend (T) or Y = a + bX

A **limiting factor or principle budget factor** means you do not have enough of a resource in order to produce or sell all you would like.

Method for limiting factor analysis

- Identify the limiting factor

- Contribution per unit

- Limiting factor used in each product

- Contribution per unit of limiting factor

- Rank

Contribution per unit =

Sales price per unit less all variable cost per unit (it ignores all fixed cost).

Contribution earned per unit of scarce resource =

Contribution per unit
Number of units of scarce resource required in order to produce it

Break even analysis or cost volume profit (CVP) analysis

Cost-volume-profit (CVP) analysis looks at how profit changes when there are changes in variable costs, sales price, fixed costs and quantity.

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Formulae to learn

Contribution per unit = Sales price per unit less variable cost per unit

Break-even volume   = $\dfrac{\text{Fixed overhead}}{\text{Contribution per unit sold}}$

Contribution to Sales ratio (C/S ratio)

= $\dfrac{\text{Contribution per unit}}{\text{Sales price per unit}}$

or = $\dfrac{\text{Total contribution from a product sold}}{\text{Total sales revenue earned from a product sold}}$

Break-even revenue

= $\dfrac{\text{Fixed overhead}}{\text{C/S ratio}}$

or =   Break-even volume x Sales price per unit sold

Margin of safety (units)

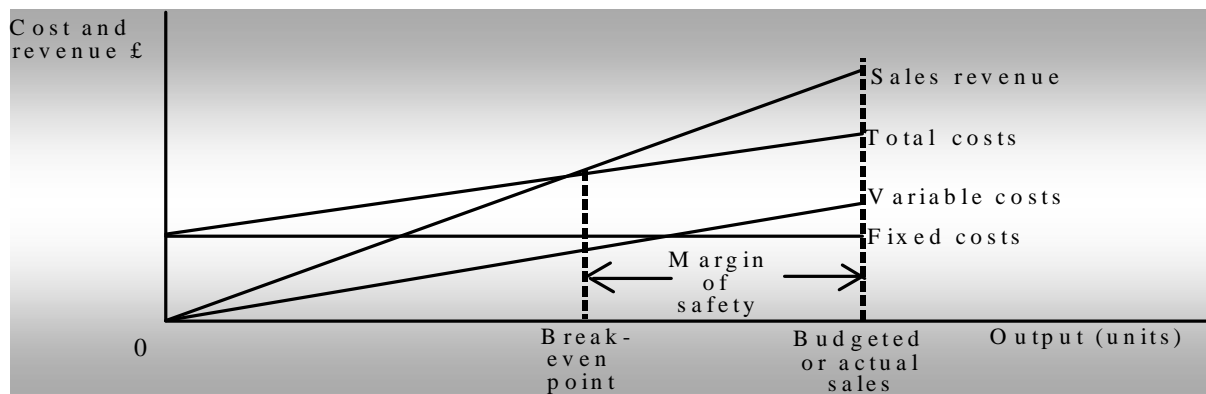= Budgeted sales volume less Break-even sales volume

Margin of safety (%)

= $\dfrac{\text{Budgeted sales volume less Break-even sales volume} \times 100}{\text{Budgeted sales}}$

Number of units sold to achieve a target profit

= $\dfrac{\text{Fixed cost + Desired profit}}{\text{Contribution per unit}}$

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Break-even charts

Profit volume charts:
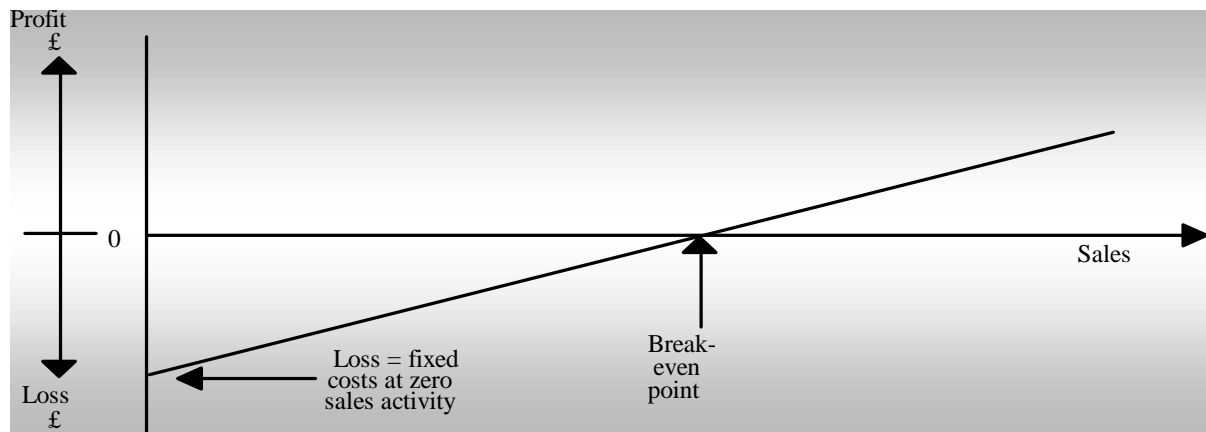
> **"What if" analysis, spreadsheets and databases used in budget preparation**
>
> **What if" analysis** looks at varying or changing the key variables to see how the outcome would change. These changes would be due to the revision of expectations on the value of variables such as material costs or demand.
>
> **Spreadsheets** are a useful tool to build models for management information and aid the preparation of budgets.
>
> A **database** organises the collection of data or information stored on a computer.
>
> A **database management system** (DBMS) manages and provides access between the different application programmes and information stored in the database.

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Absorption, marginal and activity based costing

Absorption costing

Traditional absorption costing takes the **total budgeted fixed overhead for a period and divides by a budgeted (or normal) activity level in order to find the overhead absorption rate.** This is a simple fixed overhead costing method, allowing fixed overhead to be allocated to products, jobs, and stock or work-in-progress.

Overhead absorption rate (OAR) = $\dfrac{\textbf{Budgeted production overhead}}{\textbf{Normal level of activity}}$

- Any **under charge to the profit and loss account would be an 'under absorption'** of production overhead e.g. DR profit and loss account CR Production overhead control account.
- Any **over charge to the profit and loss account would be an 'over absorption'** of production overhead e.g. CR profit and loss account DR Production overhead control account.

Marginal costing

A marginal cost (direct or variable cost) is a cost that can be avoided if a unit is not produced or incurred if a unit was produced. Fixed cost remains constant whether a unit is or is not produced. Marginal (or variable) costing assigns only variable costs to cost units while fixed costs are written off as period costs.

Cost per unit:

Direct costs of production
Direct labour	X	
Direct material	X	
Direct variable production overhead	X	
Total direct variable cost or total prime cost	**X**	**Marginal costing stock valuation**
Indirect production overhead absorbed	X	
Full production cost	**X**	**Absorption costing stock valuation**

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Marginal costing – pro forma income (profit) statement

	£	£
Sales		X
Less cost of sales		
Opening stock (valued at variable production cost only)	X	
Total variable production cost*	X	
	X	
Less closing stock (valued at variable production cost only)	(X)	
		(X)
Less non-production variable cost		(X)
Contribution		X
Less fixed production cost		(X)
Less fixed non-production cost		(X)
Net profit		X

*Direct labour, direct material and direct (or variable) production overhead

Terminology: Contribution equals **Sales less ALL marginal (or variable) cost**

Absorption costing – pro forma income (profit) statement

	£	£
Sales		X
Less cost of sales		
Opening stock (valued at full production cost)	X	
Total variable production cost*	X	
Fixed production overhead absorbed	X	
	X	
Less closing stock (valued at full production cost)	(X)	
	X	
(Over)/under absorption of fixed production overhead	(X)/X	
		(X)
Gross profit		X
Less non-production fixed and variable cost		(X)
Net profit		X

*Direct labour, direct material and direct (or variable) production overhead

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Reconciliation of absorption to marginal costing profit

AC profit	X	
Less: fixed overhead included within **Closing** inventory	(X)	**C**losing **L**ess
Add: fixed overhead included within **Opening** inventory	X	**O**pening **A**dd
MC profit	X	
		or 'CLOA'

Activity based costing (ABC)

Activity based costing (ABC) looks in more detail about what causes fixed overhead to be incurred and works out many ÷cost driversø (activities).

Steps in ABC

1. Group types of fixed overhead together.
2. Calculate from fixed overhead cost pools a fixed overhead ÷cost per driverø
3. Absorb fixed overhead using ÷multiple cost driversø

A **cost driver** is any factor that causes a change in the cost activity, so it is important to identify a causal relationship between the cost driver and the cost.

Customer profitability analysis (CPA)

Relating specific costs to serving customers or groups of customers, so that their relative profitability can be assessed. CPA uses ABC techniques in order to allocate cost.

Customer profitability analysis (CPA) focuses on cost reduction by understanding how customers consume different support resources e.g. processing, delivery, sales visits, telephone support, internet support etc. It allows an organisation to concentrate on the most profitable of its customers.

Direct product profitability (DPP)

DPP is a decision making tool that helps a food merchandiser by providing a better indication of the profitability of products on the supermarket shelves. DPP allocates direct product costs to individual products. These costs are subtracted from gross profit to derive at DPP for each product. The normal indirect costs attributed to products would be distribution, warehousing and retailing. DPP would ignore indirect costs such as head office overhead, only product specific fixed (indirect) cost would be analysed. e.g. shelf filling, warehousing and transportation.

Activity based budgeting (ABB)

ABB uses cost driver data in the budgetary planning and control stage, in other words cost levels are forecast and determined by using ABC techniques. Therefore ABB is a form of budget preparation that focuses on the activities of an organisation. All costs are related to those activities and can be split into primary activities (value added activities) and secondary activities (non-value added activities). Non-value added activities if not supporting the value added activities effectively, should be questioned as to whether it should exist at all.

Job and batch costing

Job costing is a form of specific order costing where costs are charged to individual orders or jobs for customers e.g. printers or a special purpose machine, tailor made to order.

Batch costing is a form of specific order costing; similar is most ways to job costing e.g. the job would be to manufacture a large number of identical items (or a batch), such as 1000 identical commemorative mugs.

Service costing

Characteristics of service organisations
- Intangible e.g. cannot touch or feel what is offered.
- Simultaneous e.g. cannot be returned if faulty.
- Perishable e.g. cannot be stored.
- Heterogeneous e.g. differences in the exact service supplied each time not perfectly identical (homogenous).

Why use service costing

- To help control the departments costs e.g. budgetary control
- To help improve the efficiency of how the service is used by other departments when internal or external charging takes place

Examples of cost units for service organisations

- Cost per hour
- Cost per tonne
- Cost per kilogram

Examples of composite cost units

- Cost per tonne per mile
- Cost per passenger per mile

Chapter

4

Standard costing and variance analysis

A standard cost is a planned (budgeted) or forecast unit cost for a product or service, which is assumed to hold good given –expectedøefficiency and cost levels within an organisation. A standard cost normally represents the planned (budgeted) or forecast unit cost for material, labour and overhead expected for a product or service.

Types of standard cost

- Ideal standard
- Attainable (or expected) standard
- Current standard
- Loose Standard
- Basic Standard
- Historical Standards

Practical advice for setting standards

1. Use challenging but realistic targets.
2. Consult with and allow staff to participate when setting targets.
3. Clear trust and communication between management and staff.
4. Standards or targets used must be realistic and achievable.

Standard costing can be used for

- Preparation of budgets
- Controlling performance
- Inventory valuation
- Simplifying cost bookkeeping
- Motivating and rewarding staff

Criticisms of standard costing

- Sometimes it can be hard to define a –currentøor –attainable standardø
- Less human intervention means labour standards are becoming less valuable.
- Automation produces greater uniformity and consistency of product therefore less likelihood of material and labour variances actually occurring.
- Standard costing is an internal not external control measure.
- Uncontrollability of any exceptions highlighted.
- Revision to standards too infrequent to guide or improve performance over time.
- Modern manufacturing techniques such as TQM and quality circles means the frequency and materiality of variances should not occur so often.

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Variance analysis

Variance analysis is a budgetary control technique, which compares planned (budgeted) or forecast costs and revenues to actual financial results, it measures the differences between standard (budgeted) and actual performance. Variance analysis is used to improve operational performance through control action by management e.g. investigation of any variance causes and correction of them to prevent in future any further deviations from plan.

> A variance is the difference between planned, budgeted or standard cost and the actual cost incurred. The same comparisons may be made for revenues.
> **(CIMA)**

Reasons why variances occur

- Inaccurate data used to compile standards.
- Standard used either not realistic or out of date.
- Efficiency of how operations were undertaken and performed by staff.
- Random or chance events occurring.

There are many variance proforma calculations that need to be learned and applied as part of your studies. These proforma are essential to learn and practice in order to truly understand and interpret what variances mean. Once variances have been calculated either ‗Fǿ or ‗Aǿ is used as terminology to indicate favourable or adverse differences between actual and standard performance. Favourable means that actual results were better than standard. Adverse means that actual results were worse than standard. Remember variances are just reconcilable differences between a budget (standard) and actual results so in the case of an adverse variance this would mean that actual cost will be higher or profit lower when compared to the budget, and vice versa if a variance was favourable.

Interpretation of variance calculations

In your exam you could be asked to interpret the variances you have calculated or interpret from variances already provided to you in a question. The examiner may require you to explain some possible reasons why a favourable or adverse variance has occurred. It is important to give an answer that is practical and relates to the scenario or organisation, also to apply consistent explanations with your answer e.g. if an adverse variance then give possible reasons for the cause of an adverse not favourable variance. Possible causes or reasons for variances have been included in the table below.
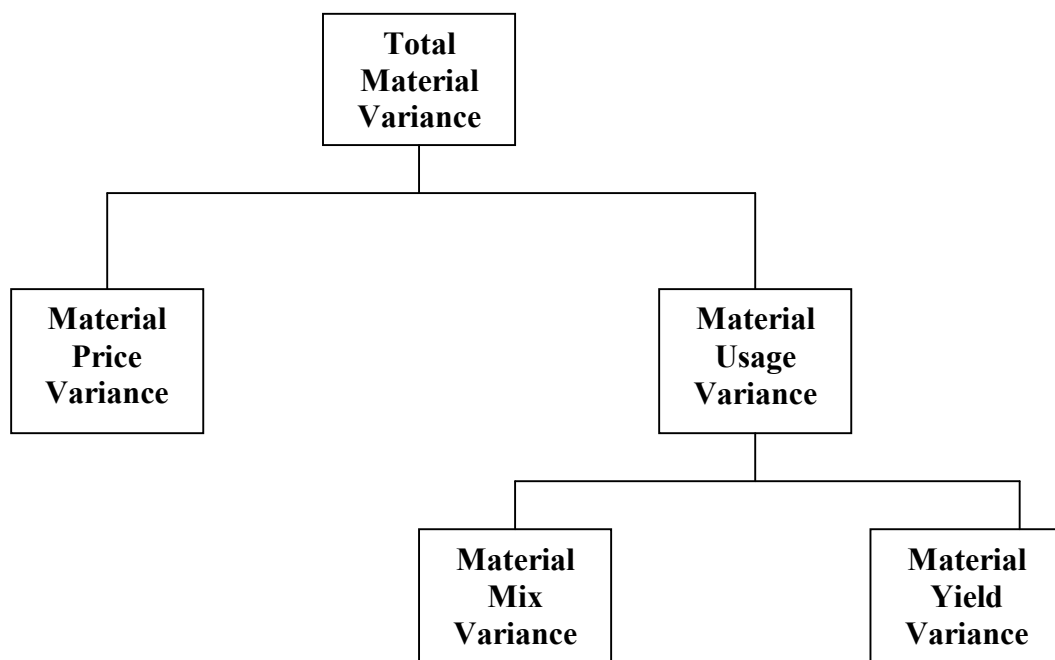
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Material mix and yield (productivity) variances

When different types of materials can be used as substitutes for each other, a standard mix can usually be determined to ensure a quality product at the lowest possible cost. If the actual material mix varies from the standard mix, both quality and cost may be affected. The sum of the material mix and yield variances will be equal the material usage variance.

The material mix variance can be calculated by using two different methods, the ─individual valuation bases─ which is the easiest to apply and the ─average valuation bases─ If the examiner does not specify which method to use, the individual valuation bases is the easiest method to apply, both methods give the same answer as a total mix variance, but the individual values for each material which make up the mix variance will be different depending on each method used.

Yield (or productivity) variances measure the amount of output (unit of product or service) from a given amount of input (total materials mixed). Producing more output than expected from a given amount of material input, indicates greater efficiency of production, the variance would be favourable, indicating that money has been saved by using material more efficiently. Producing less output than expected from a given amount of material input, indicates lower efficiency of production, the variance would be adverse, indicating that money has been wasted by using material less efficiently.

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Relationship for material variance calculations

Total Material Variance

Material Price Variance

Material Usage Variance

Material Mix Variance

Material Yield Variance

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Labour mix and yield (productivity) variances

When different types of labour e.g. different grades or skills, can be used as substitutes for each other, the labour efficiency variance can be subdivided into a mix and yield (productivity) variance when there exists two or more types of labour that can be substituted for one another e.g. to provide a service or manufacture a product. The sum of the labour mix and yield variances will be equal the labour efficiency variance.

The labour mix variance can be calculated by using the same two different methods that can be applied to material mix and yield variances, the ─individual valuation bases─ which is the easiest to apply and the ─average valuation bases─ If the examiner does not specify which method to use, the individual valuation bases is the easiest method to apply, both methods give the same answer as a total mix variance, but the individual values for each type of labour which makes up the mix variance will be different depending on each method used.

The yield variance for labour is also an identical calculation when compared to material yield. For labour mix and yield follow the same guidance as for material mix and yield but use labour hours and labour rates rather than material usage and material prices.

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Relationship for labour variance calculations
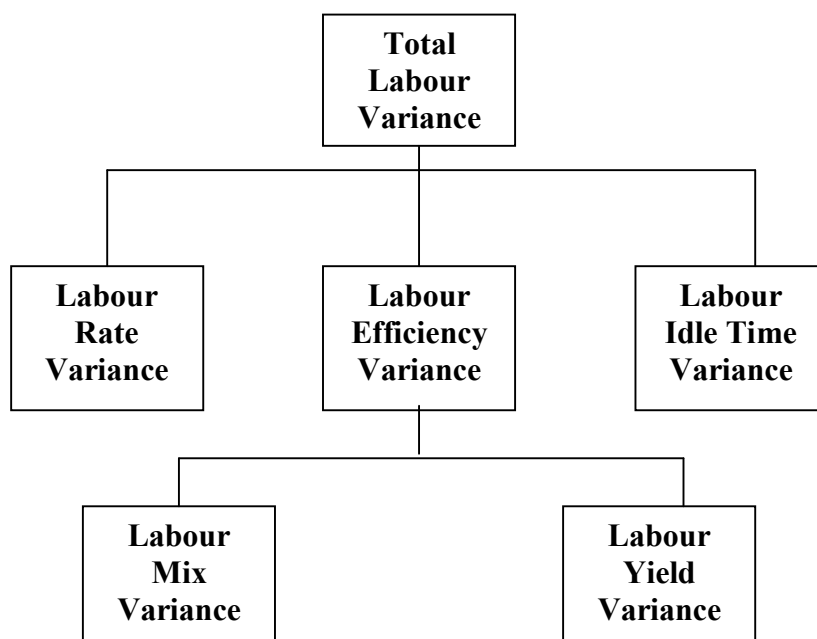
There can be an interdependent relationship (both connected to each other), between a mix and yield variance, for example a higher skill of labour used in substitute for a lower skill of labour would normally give an adverse mix variance, (higher skills normally demand a higher labour rate), but at the same time perhaps a favourable yield variance, due to the greater experience and efficiency of the higher skill of labour substituted.

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Planning and operational variances

Planning variances are caused by the budget (standard) at the planning stage being wrong e.g. budgeting errors or poor planning when the budget was prepared. The budget (standard) used would need revising if operational variance calculations are to be more realistic. Planning variances help ensure that all planning errors within the budget (standard) are adjusted for or removed; the standard used for operational variances would therefore be more realistic.

Operational variances are the normal variance calculations as learned and applied earlier within this chapter.

Process of calculating planning variances

1. All planning variances follow a similar proforma because they all adjust the flexed budget up or down due to the revision of a standard. Just like operational variances planning variances can be favourable or adverse.
2. When the planning variance is calculated and the budget (standard) adjusted, operational variances would then be calculated using any new (revised) standards.

The effect is to sub-divide variances into two components

1. The planning variance which is beyond the operational control of management and staff e.g. errors due to poor planning.
2. The operational variance which is normally within the control of staff and now more realistic as a yardstick because calculations would include any revisions to standard.

Advantages of calculating planning variances

✓ Highlights variances between controllable and uncontrollable.
✓ Helps motivate managers and staff.
✓ Better management information for control purposes.

Limitations of calculating planning variances

✘ Determining ‑bad planning‑ or ‑bad management‑ can sometimes be a thin line.
✘ Time consuming and costly than the conventional approach.

Factors to consider before investigation or control action is taken

1. Size or ‑materialityø of the variance.
2. The general trend of the variance.
3. Consideration of the type of standard used.
4. Interdependence with other variances.
5. The likelihood of identifying the cause of the variance if it were investigated.
6. The likelihood that if the cause is controllable and can be rectified.
7. The cost of investigation and correction compared to the benefits e.g. cost savings.

Statistical methods for interpretation

Variances can be expressed relatively rather than absolutely, the variance always expressed as a percentage of standard (never actual) cost. These percentages can be plotted on a graph over time to provide trend analysis for variances.

Example of a percentage variance chart
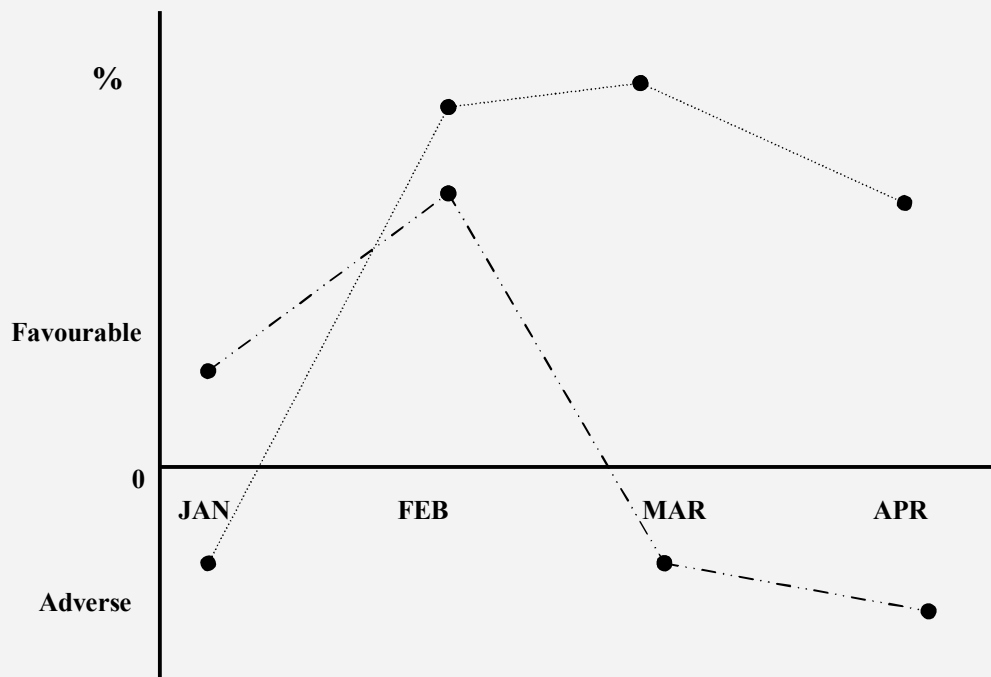
Note: Each line represents two different variances monitored over the four months.

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Benchmarking

õA continuous, systematic process for evaluating the products, services and work processes of an organisation that are recognised as representing best practice, for the purpose of organisational improvement.ö
(Michael Spendolini)

Types of benchmarking

- Internal
- Best practice or functional
- Competitive
- Strategic

The process

- Selecting what you want to benchmark

- Consider benefits against the cost of doing it

- Assign responsibilities to a team

- Identify potential partners/known leaders

- Breakdown processes to complete

- Test and measure e.g. observation, experimentation or investigation/interview

- Gather information

- Gap analysis

- Implement changes/programmes/communicate

- Monitor and control

- Repeat regularly

The characteristics of services

- **Intangibility** e.g. no material substance or physical existence
- **Legal ownership** e.g. difficult to return if faulty
- **Instant perishability** e.g. cannot be stored for future use
- **Heterogeneity** e.g. performed different each time
- **Inseparability** e.g. cannot be separated from the person who provides it

McDonaldization

George Ritver in his book ŦThe McDonaldization of Societyø listed the advantages of producing standard (homogenous or identical) products, the pinnacle comparison being McDonalds, with its fast food strategy of uniformity of operations and delivery on a global basis.

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Advantages of McDonaldization

Standardisation reduces cost and improves efficiency.

- ✓ Control
- ✓ Efficiency
- ✓ Predictability
- ✓ Calculability
- ✓ Proficiency

Diagnostic related or reference groups (DRG) 'can applied to a Big Mac'

Standard costing can be applied to service organisations such as the health services, accountancy practices, fast food outlets etc. The diagnostic reference group or healthcare resource group is a system of classifying hundreds of different medical treatments within the healthcare sector. It applies standardisation by recognising that similar medical illnesses require essentially similar treatments and care. There are around 800 DRG classifications that exist within the healthcare industry sector.

DRG applied to health care services

- Standardise resources e.g. beds/wards/consultancy time/medication etc.
- Standardise patient treatment e.g. specifications of how treatments are applied.
- Standardised codes for insurance companies or payments to the NHS (or other private health care providers) based on standard prices used.
- Government can benchmark performance and provide league tables for hospitals.

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Chapter 5

Modern manufacturing methods

Throughput accounting aims to maximise contribution whilst minimising conversion (labour and overhead) cost. Throughput accounting is also known as super variable costing.

Throughput contribution = Sales less material cost

Conversion cost = all other fixed cost

Return per factory hour calculates the benefit or contribution earned per unit of bottleneck resource.

$$\text{Return per factory hour} = \frac{\text{Sales less material cost only}}{\text{Usage (in hours) of the bottleneck resource}}$$

$$\text{TA ratio} = \frac{\text{Contribution (sales less material cost only) per hour}}{\text{Conversion cost per hour (or cost per factory hour)}}$$

Backflush accounting is a method associated with a Just In Time (JIT) production system, which attaches a standard cost to the output of a unit sold within the accounting system, standard costing may also be used for the valuation of stock and work-in-progress.

Traditional manufacturing came from the following types:

1. Job e.g. specific manufacturing to clients order.
2. Batch e.g. standardised or identical units manufactured in one operation.
3. Mass e.g. continuous production of standardised or identical units.

Lean production or the Toyota production system (TPS)

Lean production (also known as the Toyota Production System) is a manufacturing methodology originally developed by Toyota õto get the right things to the right place at the right time.ö Lean production focuses on delivering resources when and where they are needed.

Total productive maintenance (TPM) is a concept to improve the productivity of organisations equipment and can contribute towards an effective lean production system. TPM aims to shorten lead times by ensuring production and machine maintenance staff work closer together. Machine operators are empowered and trained in order to speed up routine servicing, fault diagnosis and maintenance of operating machinery.

JIT production

The JIT philosophy requires that products should only be produced if there is an internal or external customer waiting for them. It aims ideally for zero stock e.g. raw materials delivered immediately at the time they are needed, no build up of work-in-progress during production and finished goods only produced if there is a customer waiting for them.

Focus factories

Focus factories reorganise traditional factories which may make parts of several products or mass produce in anticipation of demand into stand alone factories which make a complete product. This reduces waiting time and completion of product time.

Total Quality Management (TQM)

TQM is the process of embracing a quality conscious philosophy or culture within an organisation. The philosophy aims towards perfection of standards and continuous improvement.

The four costs of quality

- Prevention cost
- Appraisal cost
- Internal failure cost
- External failure cost

Communication of quality

- Establish senior management commitment.
- Present TQM.
- Hold TQM workshops and training sessions.
- Establish quality circles.
- Establish standards by benchmarking.
- Restructure reward systems.
- Information systems to monitor and control.
- Cultural change of attitudes and beliefs over the long-term.

Quality circles is an American idea, whereby a group of 5 to 8 employees, normally working in the same area, volunteer to meet on a regular basis to identify areas for improvement or analyse work related problems in order to find solutions.

Advanced manufacturing technologies (AMT)

- Flexible manufacturing systems (FMS)
- Computer aided design (CAD)
- Computer aided manufacturing (CAM)
- Optimised production technology (OPT)
- Materials requirement planning (MRP I)
- Manufacturing resource planning (MRP II)
- Computer-integrated manufacturing (CIM)
- Enterprise resource planning (ERP)

Environmental cost accounting

Environmental cost accounting is how environmental costs are identified and allocated to the material flows or other physical aspects of a firmøs operations.

Internalised costs relating to the environment

- Environmental costs
- Environmental related taxes
- Environmental losses
- Environmental provisions
- Non financial disclosures

Energy and water useage

Energy and water consumption have proven to be both very costly to businesses as well as having significant impact on the environment through increased carbon emissions. Businesses should look towards ways of conserving the use of these resources as far as practicable. Energy and water consumption are closely liked as energy is needed to heat up water and so a reduction in water useage would mean a reduction in energy useage as well.

ABC and environmental cost accounting

Environmental cost accounting can be seen as a specific application of ABC, which focuses on the environment as a key cost driver. ABC allows us to distinguish between environmental related costs normally attributed to joint environmental cost centres (e.g. incinerators or sewage plants) and environmental driven costs, which can be direct, indirect and contingent, and which are hidden in the general overhead.

The Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European community for reducing greenhouse gas (GHG) emissions.

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The Kyoto mechanisms are:

- Emissions trading.
- Clean development mechanism (CDM).
- Joint implementation (JI).

The concept of sustainability in operations management

Sustainability within operations management is about preserving natural resources for future generations. A fully sustainable operation is one that has a zero impact, or a positive impact on the ecological environment.

ISO 14001 is an international standard for õEnvironmental Management Systemsö and offers internationally recognised environmental certification.

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Mathematical techniques for decision making

Basic concepts

- **Risk** - this may or may not occur and is quantifiable using standard deviation.
- **Uncertainty** - cannot be predicted with statistical confidence, normally due to insufficient information.
- **Expected value** ó sum of all possible outcomes multiplied by their chances of occurrence.
- **Risk seekers** ó select the best outcome ignoring the probability of achieving it.
- **Risk averse** - aim to maximise the returns from the worst outcomes.
- **Risk neutral** ó select the most likely return using expected values.
- **Payoff tables** - used where we need to make more than one decision with their own set of outcomes and probability.
- **Standard deviation and variance** - measures the spread of the data set and allows us to understand what the chances are of achieving the average or mean.

Simulation - looks at testing a forecast, budget or model several times with random figures to see what the average outcome might be.

Decision tree - graphical representation of outcomes and their probabilities organised in a way to show the sequence of events that can occur given the decision taken.

P1 revision summaries

Chapter

8

Investment appraisal

Main investment appraisal techniques

- Payback
- Accounting rate of return (ARR)
- Net present value (NPV)
- Internal rate of return (IRR)

Payback - Looks at how quickly a project takes to pay itself back.

Disadvantages of payback

- ✖ Ignores cash-flows of a project after the period of payback.
- ✖ Ignores the time value of money.
- ✖ Criticised for being too short-term in view.

Accounting rate of return ó profit over the life of the project as a % of the initial investment.

Disadvantages of ARR

- ✖ Profits can be manipulated.
- ✖ Does not account for the time value of money.
- ✖ Many different ratios so can be confusing.
- ✖ Relative (may ignore the size of the investment).

NPV ó discounts to todays value all future cash flows of a project.

Taxation

Tax on profits earned in T_1 for example, 50% of this is paid in T_1, and the other 50% is paid in T_2.

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Capital allowances

These are given in a similar way to taxation, when the asset is bought 50% received in T_1 and the other 50% being received in T_2.

Inflation

$$(1 + M) = (1 + R) \times (1 + I)$$

M = Money cost of capital
R = Real cost of capital
I = General rate of inflation

Advantages of NPV

- ✓ Takes account of the time value of money.
- ✓ It is an absolute measure.
- ✓ Uses relevant costing.

Disadvantages of NPV

- ✖ Cash flows assumed to occur at the end of a year.
- ✖ Only considers financial costs and benefits.
- ✖ Difficult to understand.

Discounted payback

The payback method can also be applied to the PV of your cash flows after discounting them, rather than the actual cash flows themselves. This would overcome the main drawback of payback as a method of investment appraisal by accounting for time value of money.

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IRR - the cost of capital that would give a project a zero NPV.

Advantages of IRR

- ✓ Accounts for the time value of money.
- ✓ Uses relevant costing.
- ✓ Easily understood.
- ✓ Easy decision criteria.

Disadvantages of IRR

- ✖ Can have multiple IRRs for the same project, usually if non-conventional cash-flows arise over the life of the project.
- ✖ May rank projects incorrectly. NPV being always the clear decision rule.
- ✖ Often confused with other calculations such as ARR or ROCE.

Capital rationing

- **"Soft" capital rationing** ó internal or political reasons why funds capped.
- **"Hard" capital rationing** ó external or real reasons why funds are capped.
- **Divisible projects** ó can invest in parts of projects.
- **Non-divisible projects** ó can only in all or none of the projects.

The process of investment decision making

The basic stages are:

- Spend forecast
- Projects identified
- Financially evaluate projects
- Consider qualitative factors
- Best options are chosen and approved
- Monitor and control project
- Deal with risk
- Post completion audit

Asset replacement theory

Replacement theory

- HOW OFTEN should a new machine be replaced? Equivalent Annual Cost (EAC).

- WHEN should replacement of the existing machine occur? Asset Replacement.

EAC

- NPV / Annuity (given a cost of capital) for the life of the project.

- Can only be used if there is no inflation.

- The annual cash flow amount that would return the NPV given, for the period of the project life.

Asset replacement

- Conduct an NPV incorporating the perpetuity of the new machine with details of the old machine.

P1 revision summaries

Chapter
10

Working capital

> **Working capital** is the capital available for conducting the day-to-day operations of the business and consists of current assets and current liabilities.

> **Working capital management** is the administration of current assets and current liabilities. Effective management of working capital ensures that the organisation is maximising the benefits from net current assets by having an optimum level to meet working capital demands.

TRADE PROCESS	EFFECTS ON CASH
Inventories are purchased on credit which creates trade payables.	Inventories bought on credit temporarily help with cash flow as there is no immediate to pay for these inventories.
The sale of inventories is made on credit which creates trade receivables.	This means that there is no cash inflow even though inventory had been sold. The cash for the sold inventory will be received later.
Trade payables need to be paid, and the cash is collected from the trade receivables.	The cash has to be collected from the trade receivables and then paid to the trade payables otherwise there is a cash flow problem.

Working capital cycle

Inventories days (time inventories are held before being sold) +	**(Inventories / cost of sales) x 365 days** +
Trade receivables days (how long the credit customers take to pay) -	**(Trade receivables / credit sales) x 365 days** -
Trade payables days (how long the company takes to pay its suppliers) =	**(Trade payables / purchases) x 365 days** =
Working capital cycle (in days)	**Working capital cycle (in days)**

P1 revision summaries

Working capital cycle in a manufacturing business

Average time raw materials are in stock + **Time taken to produce goods** + **Time taken by customers to pay for goods** - **Period of credit taken from suppliers** = **Working capital cycle (in days)**	**(Raw materials / purchases) x 365 days** + **(WIP & finished goods / cost of sales) x 365 days** + **(Trade receivables / credit sales) x 365 days** - **(Trade payables / purchases) x 365 days** = **Working capital cycle (in days)**

Overtrading occurs when a company has inadequate finance for working capital to support its level of trading. The company is growing rapidly and is trying to take on more business that its financial resources permit i.e. it is õ**under-capitalised**ö.

	Conservative policy	Moderate policy	Aggressive policy
Long term finance	Non current assets Permanent assets Temporary current assets	Non current assets Permanent assets	Non current assets Permanent assets
Short term finance	Temporary current assets	Temporary current assets	Permanent assets Temporary current assets

Working capital ratios	
Current ratio	$\dfrac{\text{Current assets}}{\text{Current liabilities}}$ (number of times)
Quick ratio	$\dfrac{\text{Current assets ó inventory}}{\text{Current liabilities}}$ (number of times)
Trade payable days	$\dfrac{\text{Trade payables}}{\text{Cost of sales (or purchases)}}$ x 365 days
Inventory days	$\dfrac{\text{Inventory}}{\text{Cost of sales}}$ x 365 days
Trade receivable days	$\dfrac{\text{Trade receivable}}{\text{Sales}}$ x 365 days
Inventory turnover	$\dfrac{\text{Cost of sales}}{\text{Average inventory}}$ x number of times

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Managing inventories

Raw material	Materials and components used to manufacture or assemble finished goods.
Work-in-progress	Incomplete finished goods e.g. finished goods which require further work before they can be sold to customers.
Finished goods	Fully completed (manufactured) goods ready for sale.
Consumables	Disposable tools or materials used for the production e.g. lubricants or cleaning material for machines, disposable tools or equipment.

Total cost of holding inventory

- **Purchase price** ó the amount that was paid for the inventories

- **Holding costs -** These include storage costs, insurance costs, cost of deterioration and damage, warehouse costs, labour and admin costs

- **Re-order costs –** these include administrative and transportation costs

- **Shortage costs** - these include cost of loss of sales, additional extra costs for emergency orders. There could also be a long term loss of reputation to the business as a result of this.

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Reorder level systems	Periodic review systems	Economic order quantity (EOQ)	ABC system
Whenever the current stock level falls below a standard reorder level, a new order is placed for a fixed amount in order to replenish stock.	Stock levels are reviewed at predetermined intervals of time e.g. 1st day of each month. Orders for stock will be placed after review.	The EOQ model determines a fixed quantity of stock to order which would minimise the total of holding and ordering cost.	High value **(A)** Medium value **(B)** Low value **(C)**
A fixed quantity is ordered at variable intervals of time.	A variable or fixed quantity is ordered at fixed intervals of time.	A fixed quantity is ordered at variable intervals of time.	Higher value items are reviewed more frequently and controlled by a greater extent than low value items.

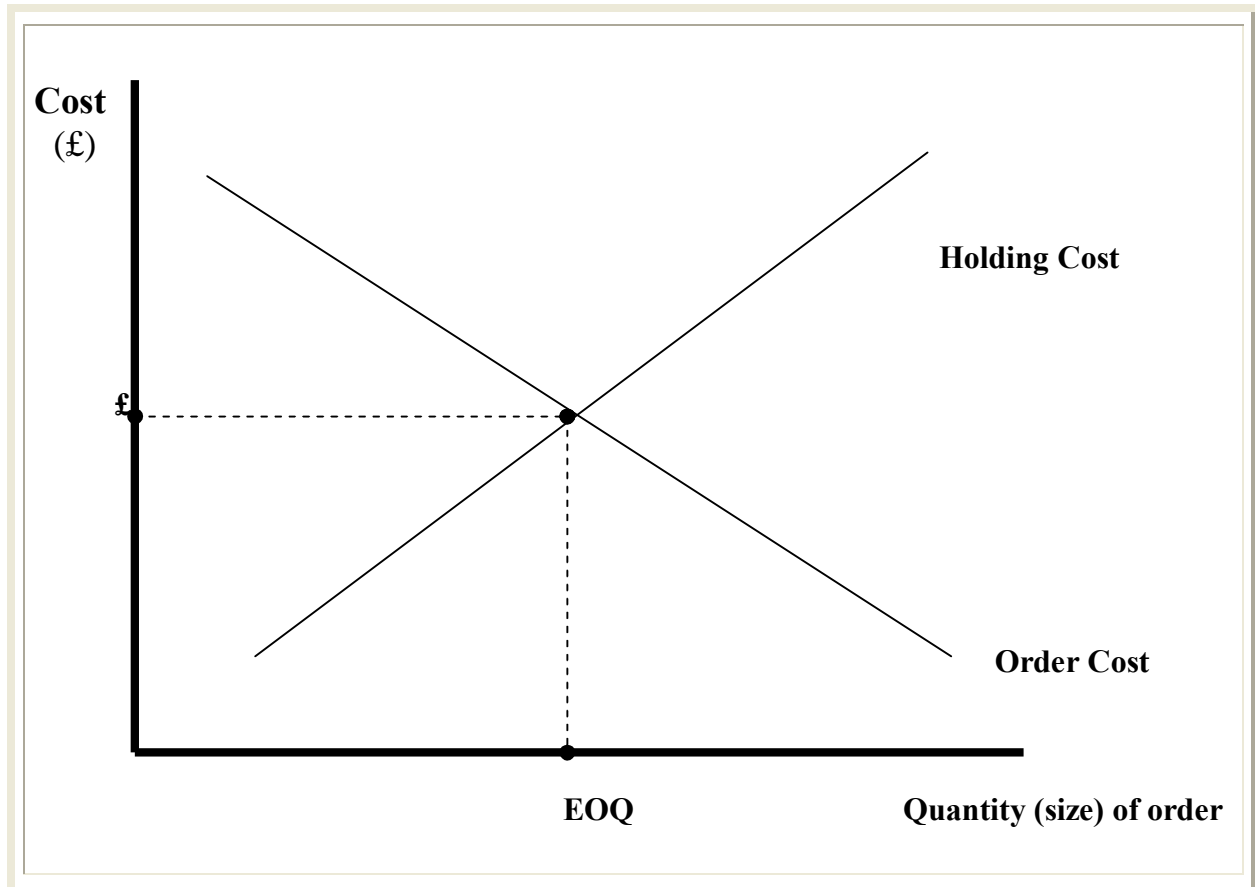**The formula for EOQ**

$$EOQ = \sqrt{\frac{2 \times C_O \times D}{C_H}}$$

Where

D   =   Annual demand (units)

C_O =   Fixed cost for each order placed

C_H =   Cost of holding one unit in stock for one year (this may include
                a cost of capital for moneyø tied upø in the value inventory)

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Cost
(£)

Holding Cost

£

Order Cost

EOQ

Quantity (size) of order

Annual ordering costs = {D x Co}/EOQ

Annual holding costs = {1/2 x EOQ x Ch}

The total annual costs
= annual ordering cost + annual holding cost + purchase cost

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The **JIT** philosophy requires that products should only be produced if there is an internal or external customer waiting for them. It aims ideally for zero stock

1. Closer relationships with suppliers maintained
2. Smaller and more frequent deliveries to plan and administrate
3. Higher quality machines with regular maintenance to avoid delays
4. Involvement and training of staff to maintain flexibility

Centralised versus decentralised purchasing

For a company with various locations, a decision needs to be taken as to who does the ordering of goods. Are they purchased locally (decentralised) or is done centrally through head office? The purchasing function is very important to inventories as the right mix of quantity, quality, price and delivery times.

Chapter

12

Managing trade receivables and payable

Trade credit is an interest free source of finance from one business to another business, and a means of creating or increasing sales for the supplier.

Consumer credit is financing given for by businesses to end consumers for the purchase of goods and services for personal consumption.

One of the main costs of extending credit rather than getting the cash in straight away from sales is the **<u>finance cost</u>**.

Credit management involves:

The benefits of extending credit to customersø versus the cost in extending the credit.

Establishing discounts, level and length of credit that will maximise profits.

Assessing the credit risk of customers by reviewing their accounting information or obtaining references.

Setting credit limits for customers and terms of payment.

Collecting debts and minimising risk of bad debts (credit control).

P1 revision summaries

Considerations before extending credit

Extra sales that will be generated from the additional credit terms.

The value of contribution of additional sales.

The additional finance costs.

The effect of additional trade receivables and payables (as more inventories will have to be purchased).

Length of extra debt collection period.

Benefits of settlement discounts	Costs of settlement discounts
- Encourages customers to pay earlier and thus reduce financing costs. - Improves liquidity as cash is received earlier. - Encourages customers to buy and therefore increase sales. - Reduction in bad debts due to reduced collection period.	- The cost of the discount will reduce cash received. - Extra administrative costs to manage the discounts given. - Customers may take the discount and still pay late if there is poor management of settlement discounts.

Compound formula for cost of early settlement discount (APR) – normally used

$$\left(\frac{100}{100 - D} \right)^{\frac{365}{N-S}} - 1 \quad \times 100\%$$

Where:

D = is discount offered in %
S = number of days credit allowed with settlement discount
N = the number of days credit offered net, for no discount

P1 revision summaries

Simple formula for cost of early settlement discount

$$\left(\frac{D}{100 - D} \quad x \quad \frac{365}{N - S} \right) \quad x \quad 100\%$$

Where:

D =is discount offered in %
S = number of days credit allowed with settlement discount
N = the number of days credit offered net, for no discount

A **credit assessment** is a judgement about the creditworthiness of a customer, providing a basis for a decision as to whether credit should be granted.

Trade references are obtained from companies that the customer has traded with.

Bank references can be obtained from the customer's bank but when asking the bank for references the precise terms should be stated in the letter to the bank.

The **financial statements** give an insight into the company's profitability and liquidity.

Credit reporting agencies or credit bureaux provide information about businesses so that suppliers can assess their creditworthiness. (e.g. Dunn & Bradstreet).

Monitoring and collecting trade receivables

Management need to ensure effective control of trade receivables collection, otherwise it could end up facing severe liquidity problems.

Efficient administration of the sales ledger

Aged receivables analysis

Reviewing credit risk regularly

Factoring is a way to release the cash on trade receivables. The factor is a specialised company, which manages the company's sales ledger by providing an advance and charging a fee.

Age analysis of receivables is a report that shows the age of debts, usually less than one month, between one and two months and greater than three months.

Bad debt is a debt, which is considered to be uncollectible and is written off against the profit and loss account or doubtful debts provision.

$$\text{Bad debts ratio} = \frac{\textbf{Bad debts}}{\textbf{Turnover or credit or total trade receivables}} \quad \text{x} \quad \textbf{100\%}$$

P1 revision summaries

Doubtful debt is a debt for which there is some uncertainty as to whether it is bad.

Doubtful debt provision is an amount charged against profit and deducted from debtors to allow for estimated non-recovery of proportion of debts.

Ways of dealing with bad debt customers

- Stopping supplies to that customer and closing their account.

- Use of collection agencies.

- Legal action.

- Liquidation or winding up of a company.

- But the costs of pursuing these courses of action need to be considered.

Management of trade payables involves:

Obtaining satisfactory credit, by ensuring a good credit history.

The ability to extend credit if cash is short. This means good supplier relationships are maintained.

If payments are delayed, this may result in loss of goodwill.

Age analysis of payables is a report that is generated by the purchase processing system and shows the age of payables, usually less than one month, between one and two months and greater than three months.

P1 revision summaries

Cash flow forecasts and managing cash

A cash-flow forecast is an estimate of when and how much money will be received and paid out of a business. Cash flow reporting is normally on a month-by-month basis, typically for one financial year.

Note: cash budgets **never include non-cash items** such as bad debts, discounts given, or the depreciation of non-current assets.

Proforma cash budget

	JAN	FEB…………….. column for each month
Cash inflow (receipts)		
Cash sales	X	X
Debtors (trade receivables)	X	X
Sale of non-current assets		X
Loan or share issues	X	X
Total Receipts	X	X

	JAN	FEB…………….. column for each month
Cash outflow (payments)		
Creditors (trade payables)	X	X
Expenses	X	X
Salaries	X	X
Purchase of non-current assets		X
Loan repayments	X	X
Taxation paid		X
Dividends paid	X	X
Total Payments	X	X

	JAN	FEB	
Opening balance brought forward	X	X	
Monthly net cash inflow/(outflow)	X	(X)	**(receipts less payments for the month)**
Closing balance carried forward*	X	(X)	

* The closing bank balance at the end of a period becomes the opening balance for the start of the next period.

P1 revision summaries

Cash management motives

There are various reasons why cash and other liquid assets are held, mainly for transactional, precautionary and speculative motives.

Transaction motive	Precautionary motive	Speculative motive
Cash needed for normal business, paying suppliers, wages etc	Cash held for unexpected purposes like increase in a liability (taxation).	Cash held for opportunities, which may arise, like a takeover of another company.

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Short term borrowing and investing

Types of short term borrowing

Trade credit
Bank loans
Bank overdraft
Debt factoring

Impact of an increase in trade credit

It is a means of short-term finance.
It decreases working capital.
It is interest free as suppliers may not charge interest.
There may be a loss in supplier goodwill, if too long is taken to pay them.
There will be a loss in early settlement discounts.

Bank loans

A bank loan also known as a term loan is a fixed amount of borrowing for an agreed period on agreed terms.

Bank overdraft

A bank overdraft is permission to overdraw on a bank account up to a specified amount for a set period. It is a negative bank balance.

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Ways of reducing investment in debtors and bad debt risk

1 Advances against collections
2 Bills of exchange
3 Documentary credits
4 Forfaiting
5 Export factoring
6 Export credit insurance
7 Acceptance credit

Short-term investments

1   Interest bearing accounts
2   Money market deposits
3   Government stock/bonds
4   Local authority stock/bonds
5   Corporate bonds
6   Certificates of deposit
7   Bills of exchange

Simple interest

Simple interest is interest that is earned in equal amounts each period and which is a given proportion of the original investment.

$$S = X + nrX$$

Where:

X	**=**	**Principal invested**
r	**=**	**Interest rate (as a proportion)**
n	**=**	**Number of periods**
S	**=**	**Sum invested after n periods (future value)**

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Compound interest

Compound interest is interest calculated with the principal amount plus any previous interests added to it.

$$S = X(1 + r)^n$$

Where:

X	**=**	**Principal invested**
r	**=**	**Interest rate (as a proportion)**
n	**=**	**Number of periods**
S	**=**	**Sum invested after n periods (future value)**

Regular investments

Regular investment is when an investment into which equal annual instalments are paid in order to earn interest, so that by the end of a given number of years, the investment is large enough to pay off a known commitment at that time.

$$S = \frac{A(R^n - 1)}{R - 1}$$

Where:

A	**=**	**annual payment into the fund**
R	**=**	**1 + interest rate**
n	**=**	**the number of terms**
S	**=**	**final value**

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Coupon rate on debt is the actual annual rate of interest payable on the nominal value of the debt. All debt is issued in blocks of £100 (this is known as the par, face or nominal value).

Yield to maturity or gross redemption yield is the internal rate of return of the cash flows (interest payments and redemption premium), associated with a loan stock.

Method to calculate the yield to maturity

Calculate a positive NPV and a negative NPV of redeemable debts cash flows (usually use 5% and 15% discount factors).

Apply formula to find IRR (interpolation).

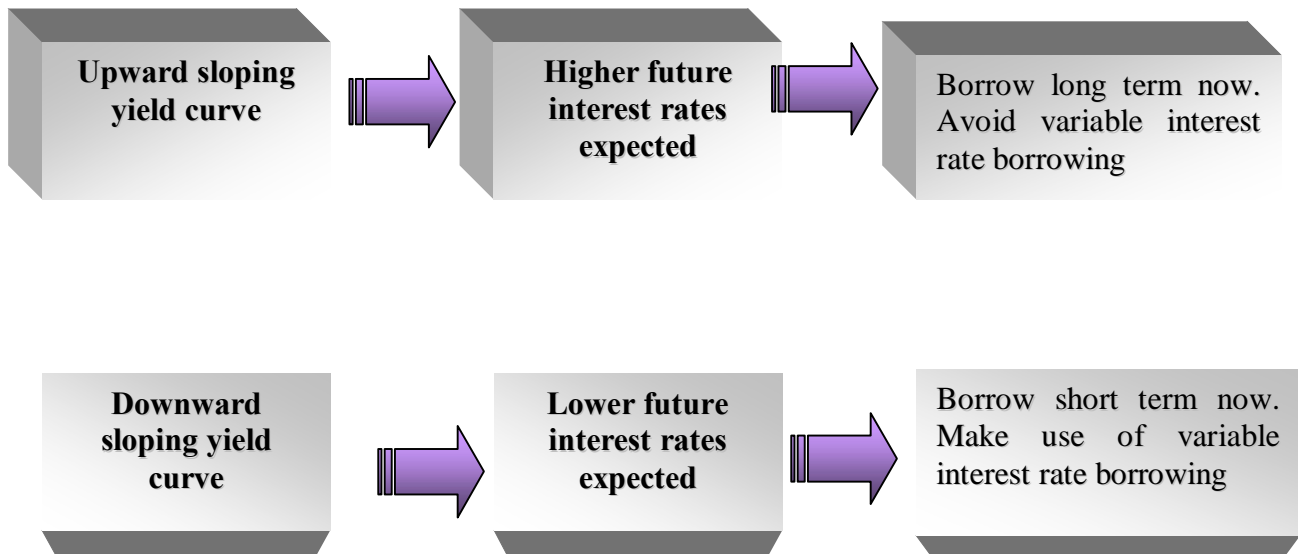$$A + \left[\frac{a}{a \acute{o} b} \times (B\text{-}A) \right]$$

Where
A = lower discount factor
B =   higher discount factor
a = positive NPV
b = negative NPV

A graphical method below can also be used to estimate the yield to maturity.

Yield curve theory

The yield curve demonstrates the variation of returns on securities with respect to their maturity and market conditions.

The yield curves shows how interest rates are likely to move in the future.

| Upward sloping yield curve | → | Higher future interest rates expected | → | Borrow long term now. Avoid variable interest rate borrowing |

| Downward sloping yield curve | → | Lower future interest rates expected | → | Borrow short term now. Make use of variable interest rate borrowing |

It is important to note that relying purely on the yield curve to make decisions on future interest rates is dangerous. Other factor could affect future interest rates like levels of inflation and general economics.

P1 revision summaries

The normal distribution

The normal distribution represents the probability distribution of continuous data.
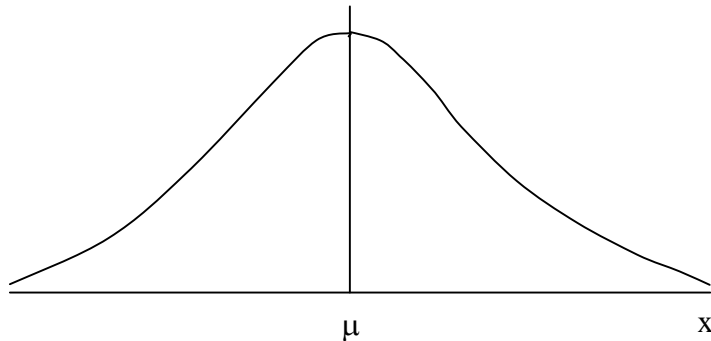
As you can see the normal distribution is a bell shaped curve. The mean (μ pronounced õmewö) is at the centre of the graph and x represents the data set values.

Characteristics of the normal distribution

- It is symmetrical around the mean.
- The mean is also the mode (the most frequent) as well as the median (the middle item of the data set).
- The area under the curve is 1.
- How wide the distribution is about the mean is dictated by the standard deviation õσö (pronounced õsigmaö).
- The variance or õσ²ö is standard deviation squared.
- 99% of the distribution is contained within +3 or ó3 of μ.
- The curve never touches the horizontal axis.

How do we measure the area under the curve?

Tables have been produced which give the percentage of the total population under the curve for different areas under the curve. We use the following formula to find the percentage or õzö value:

$$Z = \frac{x - \mu}{\sigma}$$

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