FOR THE
IB DIPLOMA
PROGRAMME

Business Management

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PREPARE FOR SUCCESS

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Contents

Business management toolkit

Introduction

How to use this book

This book will help you to plan your revision and work through it in a methodological way. It follows the IB Business Management syllabus topic by topic, with revision and exam practice questions to help you check your understanding.

Features to help you succeed

EXPERT TIPS

These tips give advice that will help you boost your final grade, in some cases including identifying typical mistakes that students make, and explaining how you can avoid them.

Key terms

Key terms appear in these boxes, and are highlighted and defined throughout the book. A glossary of essential terms is given at the end of the book.

KEY CONCEPT

The four key concepts will be discussed in these boxes: change, creativity, ethics and sustainability.

WORKED EXAMPLES

Some parts of the course require you to carry out mathematical calculations, plot graphs, and so on. These worked examples show you how.

EXAM PRACTICE QUESTIONS

Exam practice is given for the type of questions you might get. For the longer essay questions, sample sentences and paragraphs are given to show what examiners are looking for in your essay answers. For easy reference, the exam paper is indicated for each question. Use these questions to consolidate your revision and to practise your exam skills. Answers are available at **www.hoddereducation.com/ib-extras**

BUSINESS MANAGEMENT TOOLKIT

Guidance on the set of situational, planning and decision-making tools.

You can keep track of your revision by ticking off each topic heading in the book.

Use this book as the cornerstone of your revision. Do not hesitate to write in it and personalize your notes. Use a highlighter to identify areas that need further work. You may find it helpful to add your own notes as you work through each topic. Good luck!

Getting to know the exam

Exam paper	Duration	Format	Topics	Total marks
Paper 1	1 hr 30 mins	Structured questions based on a pre-released statement	All	30
Paper 2	1 hr 30 mins (SL) 1 hr 45 mins (HL)	Structured questions based on stimulus material	All	40 (SL) 50 (HL)
Paper 3 (HL only)	1 hr 15 mins	Unseen stimulus material about a social enterprise	All	25

At the end of your IB Business Management course, SL students will sit two papers – Paper 1 and Paper 2. Paper 1 is worth 35% of the final marks and Paper 2 is worth 35% of the final marks. The other assessed part of the course (the remaining 30%) is made up of the Internal Assessment, which is marked by your teacher, and externally moderated.

HL students will sit an additional paper – Paper 3, worth 25%. For HL students, Paper 1 is worth 25% of the final marks, and Paper 2 is worth 30% of the final marks. The other assessed part of the course (the remaining 20%) is the Internal Assessment (or IA) which is marked by your teacher and externally moderated.

Countdown to the exams

4–8 weeks to go

- Start by looking at the syllabus and make sure you know exactly what you need to revise.
- Look carefully at the contents list in this book and use it to help organize your class notes and to make sure you have covered everything.
- Work out a realistic revision plan that breaks down the material you need to revise into manageable pieces. Each session should be around 25–40 minutes, with breaks in between. The plan should include time for some relaxation.
- Read through the relevant chapters of this book and refer to the Expert tips, Key terms definitions, and Worked examples.
- Tick off the topics that you feel confident about, and highlight the ones that need further work.
- Look at past exam papers. They are one of the best ways to check your knowledge and practise exam skills. They will also help you identify areas that need further work.
- Try different revision methods, for example summary notes, mind maps and flash cards.
- Test your understanding of each topic by working through the Exam practice questions.
- Make notes of any problem areas as you revise, and ask a teacher to go over them in class.

1 week to go

- Aim to fit in at least one more timed practice of entire past papers, comparing your work closely with the mark scheme.
- Examine the contents list of this book carefully to make sure you haven't missed any of the topics.
- Tackle any final problems by getting help from your teacher or talking them over with a friend.

The day before the examination

- Look through this book one final time. Look carefully through the information about each exam paper to remind yourself what to expect, including timings and the number of questions to be answered in each section of the papers.
- Check the time and place of the exams.

- Make sure you have all the equipment you need (for example extra pens, a pencil and a ruler for diagrams, a watch, tissues and water).
- Allow some time to relax and have an early night so you are rested and ready for the exams. There is a huge opportunity cost if you are not refreshed!

My exams

Paper 1

Date: ……………………………..

Time: ……………………………..

Location: ………………………...

Paper 2

Date: ……………………………..

Time: ……………………………..

Location: ………………………...

Paper 3 (HL only)

Date: ……………………………..

Time: ……………………………..

Location: ………………………...

- Hence, culture clashes are a major reason why many M&As and takeovers fail to succeed.
- Miscommunications in the workplace are more likely to happen as a firm grows in size. Different languages being used by workers can create sub-cultures and cause further barriers to effective communication.
- As firms grow or evolve, a new vision and mission statement may be created, but could be met with resistance to change from the workforce. Again, this can cause some conflict within the organization.

- Charles Handy argued that organizations with a person culture have individuals who see themselves as unique and superior to the organization. Such people can therefore exert major influence on organizational culture, especially when there is a change in leadership or management in the organization.
- Organizational cultures can and do change over time. As a firm grows or evolves, or as the external business environment changes, markets become more competitive, which may necessitate managers to change the way in which things are done within the organization. To survive, it may be necessary to introduce new ideas and practices, ensuring people are able to adapt.

KEY CONCEPTS

Investigate how **change** and **creativity** have influenced the corporate culture for an organization of your choice.

2.6 Communication

SL/HL content	Depth of teaching
Formal and informal methods of communication for an organization in a given situation	AO3
Barriers to communication	AO2

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Formal and informal methods of communication for an organization in a given situation (AO3)

- **Communication** is the transfer of information from one party to another.
- Managers spend a significant proportion of their time communicating with internal and external stakeholders. Hence, effective communication is essential for businesses to be successful.
- Effective communication enables managers and workers to have a better understanding of and control over what they do.
- It is important for managers to understand different forms of communication (such as verbal, non-verbal, and written), irrespective of whether they are used formally or informally.
- Conflict resolution and negotiation skills (see Chapter 2.7) are important aspects of communication in business management, as disputes and disagreements are an inevitable part of any business.

- New communication technologies, such as the widespread use of emails, instant messaging services, corporate websites, video conferencing, and artificial intelligence (see Chapter 5.9), have had a significant impact on communications in business organizations.
- Cultural differences can impact communication, so it is important for managers to be aware of and sensitive to these differences, in order to communicate effectively with stakeholders from different and diverse backgrounds and cultures.
- Methods of communication can be categorised as formal or informal.

Formal methods of communication

- **Formal communication** refers to the flow and exchange of official information through authorized and predefined channels. Communication follows approved hierarchical structures and chains of command.
- This type of communication conforms to the prescribed professional standards and practices of the organization.

Examples of formal methods of communication include the following:

- *Meetings*. These are official gatherings of individual staff members to discuss work-related matters, and to make formal decisions. Meetings can be held in person (face to face) or virtually (online). A meeting agenda is used to outline the matters to be discussed.
- *Minutes*. These are official written records of the discussions in meetings, including decisions made and actions to be taken. They are usually produced by a secretary or assigned person at the meeting, and distributed to attendees for approval (to authenticate the document).
- *Emails*. Electronic mail is a form of written communication used to convey information quickly and efficiently using devices connected to the internet or computer networks, with the option to include attachments (such as documents, images, and videos). Emails are widely used in the business world for sending and receiving messages and sharing files and documents.
- *Memos*. A memorandum (or memo) is a type of short written communication used to convey information quickly and succinctly within an organization. They are used for internal communications only, often for sending reminders or announcements.
- *Letters*. As a type of formal written communication, letters are used to convey information to internal stakeholders (such as letters of appointments to a position in the firm) and external parties (such as customers, creditors, or suppliers). They are used for official correspondence, such as business proposals, customer complaints, or letters of resignation.
- *Reports*. These are detailed documents written in formal language. They are used to inform, persuade, or make policy recommendations. They are structured with a typical format, including an executive summary, an introduction, the main body containing the main findings and analysis, plus a conclusion.
- *Presentations*. These are oral and visual communication channels used to inform and/or persuade an audience. Unlike meetings, which involve discussion, presentations are predominantly a one-way communication, delivered in person or remotely by the presenter.
- *Press releases*. A press release is a written or recorded form of communication that is sent to members of the news media for publication or broadcast. The purpose is to provide information about a specific event, issue, or announcement (such as a product launch or an official response to a crisis). Press releases are often used to stimulate the interest of journalists and to encourage them to uncover and share the message contained in the release.

- *Contracts*. These are legally binding agreements between two or more parties, such as the terms and conditions of a business arrangement, sale and purchase agreement, or employment contracts.

Table 2.17 The main reasons to implement formal communication in the workplace

The main reasons to implement formal communication in the workplace	
It clearly defines and establishes authority.	It reduces the likelihood of mistakes and errors.
It can create discipline and consistency in communications within the workplace.	It can improve work co-ordination within and across different departments.
It tends to be more credible when sending important messages.	It improves overall efficiency by significantly reducing any ambiguities.

Informal methods of communication

- Informal methods of communication refer to the unofficial and unstructured ways of sharing information within a business organization.
- Such communications do not follow formalized channels or protocols, but typically take place in private between people who have established a social relationship.

Examples of informal methods of communication include the following:

- *Gossip*. This refers to the informal sharing of information or communicating rumours, often in a private or discreet manner. It is often, but not always, the spreading of unverified information, but can also be a useful way to disseminate information quickly. However, rumours and gossip can have a significant impact on perceptions and decision making in the workplace. Hence, such informal communications can be harmful to people and the organization if not handled appropriately.
- *Small talk*. This refers to the exchange of casual or trivial conversations, typically as part of polite social interactions, such as asking about someone's day. It can be an effective way to build social relationships at work (getting to know someone) and to connect with other work colleagues who do not necessarily work in the same department. Such informal communications can help to establish a friendly or comfortable working atmosphere, but can disrupt productivity if not managed carefully.
- *Body language*. This is a form of non-verbal communication, such as facial expressions, gestures, posture, and tone of voice. It can be an effective way to convey feeling or intent, but can also be misinterpreted or misused in certain situations.

Table 2.18 The main reasons to embrace informal communication in the workplace

The main reasons to embrace informal communication in the workplace	
Employees can be more flexible and responsive to changing situations.	There is greater focus on individuals rather than hierarchical rankings.
It can be advantageous for encouraging supportive relationships in the workplace.	It can create a positive culture that encourages creativity, inclusion, and open communication.
There are more opportunities for communicating about different topics and issues across different areas of the business.	It provides the social and cultural contexts that help people connect with one another at work, including in formal work processes.

Barriers to communication (AO2)

- The phrase *barriers to communication* refers to any obstacle to effective communication in the workplace or the business world. It is often referred to as 'noise', as the barriers act to block or distort the message being communicated.
- Communication difficulties tend to exist more in larger organizations, but can certainly affect smaller businesses too.

- Barriers to communication include language, physical, psychological technological, and organizational barriers:
  - *Language barriers*. The spoken and written language can make it problematic for people to communicate effectively with each other. For example, customers may speak a different language, accents and tones might cause misinterpretations, and jargon (or technical language) can make it challenging for people to understand the message being conveyed.
  - *Physical barriers*. Tangible hurdles can include physical distance (including different time zones) and poor infrastructure. These obstacles make it difficult for people to communicate with each other in person or online.
  - *Psychological barriers*. Intangible hurdles (or emotional barriers) can also exist, such as feelings of fear, anger, resentment, bias, or mistrust. These obstacles can also prevent people from communicating openly and effectively with one another.
  - *Technological barriers*. Poor internet connectivity and the use of outdated capital equipment can make it difficult for different stakeholders (such as workers, managers, suppliers, and customers) to communicate effectively through digital channels. Information overload from the overexposure of online content can also create difficulties for effective communication.
  - *Organizational barriers*. These are internal obstacles created within the organization, such as rigid hierarchical structures (see Chapter 2.2), bureaucracy, or the lack of formal communication channels. These obstacles can prevent information from flowing freely and efficiently within the organization.

EXAM PRACTICE QUESTIONS

1 Define the term 'formal communication'. [2]

2 Explain **two** ways in which technology impacts on communication within a business. [4]

3 Explain how effective communication can lead to improved productivity in an organization. [4]

2.7 Industrial/employee relations (HL only)

HL content	Depth of teaching
Sources of conflict in the workplace	AO2
Approaches to conflict in the workplace by employees: collective bargaining, work-to-rule, and strike action	AO3
Approaches to conflict in the workplace by employers: collective bargaining, threats of redundancies, changes of contract, closure and lock-outs	AO3
The following approaches to conflict resolution: conciliation and arbitration, employee participation and industrial democracy, no-strike agreement, and single-union agreement	AO3

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Sources of conflict in the workplace (AO2)

- Conflict occurs when the needs and wants of employees (or any stakeholder group) are ignored or unmet.
- Incompatible opinions and values within an organization (different perspectives or points of view) are a major source of conflict, as this causes disagreements between different stakeholders.

KEY CONCEPT

Discuss the importance of **ethics** and **sustainability** for investment decisions.

EXPERT TIP

This unit only considers the quantitative tools used in investment appraisal. In reality, qualitative techniques are also used to determine whether an investment project is worthwhile, and whether the investment decision is in line with the organization's vision or mission, business objectives, corporate culture, market trends, and external factors, such as forecasts about the economy.

3.9 Budgets (HL only)

HL content	Depth of teaching
The difference between cost and profit centres	AO2
The roles of cost and profit centres	AO2
Constructing a budget	AO2, AO4
Variances	AO2, AO4
The importance of budgets and variances in decision making	AO2

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The difference between cost and profit centres (AO2)

- A **cost centre** is a department or division within an organization that is responsible and held accountable for its own costs.
  - The cost centre does not generate any direct revenue but adds to the cost of running the business.
  - Examples include the following departments: personnel (human resources), research and development (R&D), marketing, technical support, and customer service.
- A **profit centre** is a department or division within an organization that is responsible and held accountable for both its own costs and revenues, and hence the resulting profits.
  - An example is multiple chain businesses, with each branch or store of the organization responsible for its own profits or losses.
  - As with cost centres, the managers of profit centres are held accountable for their financial performance. Typically, managers of profit centres are responsible for achieving a target level of profit.

The roles of cost and profit centres (AO2)

- *Monitoring and control.* Cost and profit centres help businesses to control each aspect of their operations. This is particularly the case for large and expanding businesses. Thus, it becomes easier and more accurate to monitor the organization's performance by using variance analysis of each centre.
- *Motivational.* Empowering, entrusting and delegating responsibility to cost and profit centres can be highly motivating for employees.
- *Enhancing decision making.* The speed and the quality of decision making improves, because managers of cost and profit centres are empowered to make autonomous decisions.

- *Accountability*. Using cost and profit centres helps to make managers accountable for their specific responsibilities, including the ability to control costs and/or revenues.
- *Strategic planning*. Profit centres can be used for strategic planning and resource allocation if there is sufficient data generated about which centres incur the most cost and/or contribute the most revenue to the organization.

However, there are limitations of establishing cost and profit centres. These include the following:

- Centres can create unhealthy and destructive competition between the various departments, hindering the organization's ability to reach its targets.
- Distributing the firm's fixed costs to cost and profit centres is somewhat of a subjective and arbitrary task, so can lead to arguments between employees. For example, how should rents and utility bills be split between the various centres?

Constructing a budget (AO2, AO4)

- A budget is a plan of the costs and revenues with the purpose of achieving the objectives of a business in a given time period, usually one year.
- A budget usually includes all the trading activities of a business and its predicted level of sales revenue and costs (see Table 3.11 for the IB's prescribed format for constructing a budget).
- Budgets are used widely in almost all organizations, irrespective of their size or which sector they operate in. For example, theme parks such as Disneyland and Universal Studios set budgets for their sales (from admission tickets), catering (in their food outlets), and retail shops (for merchandise).
- Constructing a budget is relatively straightforward, as it simply requires managers to identify all sources of revenue and items of expenditure. For example:
  - Revenue can come from sales revenue (selling goods and services) and interest earned from cash balances at the bank.
  - Cost items include expenditure on salaries and wages for employees, materials from suppliers, rent, advertising, and electricity.

■ **Table 3.11** IB prescribed format for a budget for both profit and non-profit business entities

All figures in $'000	**Budgeted figure**
Revenue	
Sales revenue	500
Interest earned	10
Total revenues	**510**
Costs	
Salaries and wages	120
Materials	65
Rent	25
Advertising	10
Electricity	15
Total costs	235
Excess of revenues over (under) costs	275

Key terms

A **favourable variance** exists when the difference between the actual and budgeted figure is beneficial to the business, for example if sales revenues are higher than planned and/or costs are lower than planned.

An **adverse variance** exists when the difference between the actual and budgeted figure is disadvantageous to the business, for example when actual sales revenues are lower than planned, or wages are higher than budgeted.

Variances (AO2, AO4)

- A **variance** exists when the actual outcome differs from the budgeted figure. For example, a variance would occur if sales were planned to be 5,000 units, but actual sales were only 4,500 units.
- Variances are measured for a specified time period, such as per month, quarter, or year, by comparing the actual result with the budgeted figure (see Tables 3.12 and 3.13).
- Variances are classified as either **favourable variances** (if they cause higher than expected profits) or **adverse variances** (if they result in a fall in profits).

Table 3.12 Examples of variances for Tomiyasu Garments Co.

Variable	Budget	Actual	Variance
Sales of product A (units)	1,000	1,110	Favourable variance of 110 units
Sales of product B (kg)	50,000	45,000	Adverse variance of 5,000 kg
Raw material costs ($)	45,000	51,000	Adverse variance of $6,000
Wages ($)	$110,000	$107,000	Favourable variance of $3,000

Table 3.13 IB prescribed format for constructing budgets and calculating variances

Budget for (name of business) for the period ended 20XX

All figures in $'000	Budgeted figure	Actual figure	Variance
Revenue			
Sales revenue	500	480	20(A)
Interest earned	10	14	4(F)
Total revenues	510	494	16(A)
Costs			
Salaries and wages	120	135	15(A)
Materials	65	68	3(A)
Rent	25	25	0
Advertising	10	8	2(F)
Electricity	15	20	5(A)
Total costs	235	256	21(A)
Excess of revenues over (under) costs	275	238	37(A)

[F] = Favourable variance

[A] = Adverse variance

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- Budgetary control is important for effective financial management. Variance analysis can help managers to get early warning signs of potential financial problems. For example, if sales of a particular product are below budget, managers can respond by reducing output or increasing marketing expenditure in an attempt to increase sales.
- Variance analysis also allows businesses to examine whether budgets and targets are being adhered to. Hence, variance analysis acts as an additional financial control mechanism.
- The budgeting process and variance analysis help to ensure that no department or individual budget holder spends more than the business expects, thereby preventing any unpleasant surprises.

EXAM PRACTICE QUESTIONS

1 Calculate the variance for the following items for Anita Maria Caterers Co.:
  a Cost of materials: budgeted = $10,000 but actual = $11,500 [1]
  b Cost of labour: budgeted = $3,700 but actual = $3,200 [1]
  c Sales of cakes: budgeted = $26,000 but actual = $24,800 [1]

2 Cleo Williamson runs a successful hair salon business. Her latest monthly budget is shown in the table below.
  a Explain why Cleo Williamson uses budgets. [2]
  b Complete the missing figures for Cleo Williamson Hair Salon. [4]

Variable	Budgeted ($)	Actual outcome ($)	Variance ($)
Wages		4,400	400 adverse
Salaries	6,500	6,500	0
Stock	1,700	1,800	
Revenue	16,550		340 favourable
Direct costs	3,600	3,450	

  c Suggest why a favourable variance might be investigated by Cleo Williamson. [2]

The importance of budgets and variances in decision making (AO2)

- Budgets and variance analysis are important in strategic planning because they ensure that the financial implications of business decisions are fully considered.
- By empowering budget holders, the process can allow the board of directors to concentrate on core business issues (strategic planning) and only to get involved if significant variances or problems occur.
- Budgets enable a business to turn its strategy into practice. This is because all business operations need to be funded by the money allocated to various budgets of the organization.
- The budgeting process and variance analysis help to provide a benchmark against which a manager's success (or lack of) can be measured and rewarded, for example, a sales manager who exceeds an agreed sales budget might receive an annual performance bonus or qualify for the company's share ownership scheme (see Chapter 2.4).
- The effectiveness and appropriateness of leadership in the organization become questionable if budgets are ignored or not adhered to.
- Budgets and variance analysis enable senior managers and other key stakeholders to measure the degree of success or failure of the firm's business strategy.

EXPERT TIP

Budgets and variance analysis do not, on their own, ensure successful strategic planning and implementation. Although they are useful management tools for monitoring business operations, they are based on assumptions and predictions that may prove to be inaccurate. There are many external influences that can cause a divergence between actual and planned outcomes.

BUSINESS MANAGEMENT TOOLKIT

Discuss how different aspects of Hofstede's cultural dimension (HL only) can influence the budgeting process in business organizations.

EXPERT TIP

While quantitative techniques such as force field analysis, Gantt charts, and decision trees provide quantifiable answers to complex decisions, it is important to remember that effective decision making often requires managers to also consider qualitative factors, including, for example, the impact of decisions on the workforce and whether the decision is in line with the organization's values and business objectives.

7 DESCRIPTIVE STATISTICS

SL/HL content	Depth of teaching
Descriptive statistics. These include the following: mean, mode, median, bar charts, pie charts, infographics, quartiles, and standard deviation.	AO2, AO4

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Descriptive statistics (AO2, AO4)

- **Descriptive statistics** is a division of statistics that summarizes and expresses data in useable ways to support analysis and decision making.
- It involves the use of measures such as averages (mean, mode, and median), graphical tools to visually represent the data (such as bar charts, pie charts, and infographics), and measures of dispersion or spread in a data set (such as quartiles and standard deviation).
- The purposes of descriptive statistics are to provide a general understanding of the data and to identify any patterns or trends within the data.
- These statistical tools help managers to identify any patterns and trends in the data set that might not be immediately obvious or easy to determine from the raw data.

Mean

- The **mean** (or arithmetic mean average) is the most common measure of the average value in a set of data.
- It is calculated by adding up all the values in a data set and then dividing this total by the number of items in the set of data.
- For example, the following data show the number of years that each worker in the sales department of a firm has been with the company for: 3, 5, 7, 9, and 11. To calculate the mean:
  - Add up all the values: 3 + 5 + 7 + 9 + 11 = 35
  - Divide the total (35) by the number of items in the data set (5).
  - Hence, the mean = 35 ÷ 5 = 7.
- The mean can be used to express the average figure in variables such as financial data, production data, and survey responses.
- It can also be used to make comparisons between different groups or sets of data, such as the monthly average sales revenue of different branches of a coffee company.

EXAM PRACTICE QUESTION

The average daily sales of a convenience store in a typical week are shown below.

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
$3,500	$3,000	$4,500	$5,000	$8,000	$8,600	$2,300

Calculate the mean value of sales for the convenience store. [2]

Mode

- The **mode** is the second method of measuring the average figure in a data set. It is the value that appears most frequently in the data set.
- For example, the mode can be used to identify the most popular item in an organization's product portfolio, the most frequent age group of the firm's customers, or even the most common category of customer complaints.
- A business is able to use the mode to prioritize production and marketing efforts for that particular product. Conversely, it might also use the mode to consider discontinuing products that are least popular.
- It is possible to have more than one mode in a data set (multimodal data set) or even no mode at all (non-modal data set). This is a limitation of using the mode to express an average value.

EXAM PRACTICE QUESTION

The data below shows the number of toys sold by a retailer during the past month:

A	B	C	D	E
50	60	80	70	40

Describe the mode from the data above. [2]

Median

- The **median** is the third and final measure of the average figure in a set of numbers. It is the middle value when the items in a data set are placed in numerical order from the lowest to largest value.
- It is used to identify the typical or middle value in a data set, which can then be useful for making comparisons or identifying patterns. For example, the median can be used to determine the average income of a firm's employees or the median sales revenue of the different products sold by the business.

WORKED EXAMPLE

A firm has the following sales revenue over the first five trading months of the year and wants to determine its median sales value.

Month	1	2	3	4	5
Sales ($)	12,000	15,000	13,000	16,000	14,000

First, place the values in numerical order: $12,000, $13,000, $14,000, $15,000, $16,000.

Identify the value in the middle as the median value, i.e. $14,000.

- Using the median is particularly useful when there are outliers in the data set or if it is skewed (which would affect or distort the value of the mean).
- If there is an even number of data items in the data set, the median is the average of the two middle values.

WORKED EXAMPLE

Month	1	2	3	4	5	6
Sales ($)	12,000	15,000	13,000	16,000	14,000	$14,500

In this example, the median would be calculated as follows:

The values placed in numerical order gives two middle values: $12,000, $13,000, **$14,000**, **$14,500**, $15,000, $16,000.

The median is the average of these two middle values, i.e. ($14,000 + $14,500) ÷ 2 = $14,250.

Bar charts

- A **bar chart** is a graphical representation of processed data. The length of each bar in the chart shows the frequency or quantity of different categories of the data, for example sales revenue or sales volume.
- Bar charts are particularly useful in business management for visualizing data that can be divided into categories or groups. They can also be used to show the distribution of data across different categories (see Figure BMT.6).
- The bars in a bar chart are typically positioned horizontally or vertically, with the values shown along the axes.
- The chart in Figure BMT.6 shows that Product C is the best-seller in a firm's product portfolio, as sales revenue is $80,000. This is higher than any other product it sells. By contrast, Product D is the least popular item, with sales of only $10,000. By looking at the bar chart, management can easily compare the revenue of each product and make decisions accordingly.

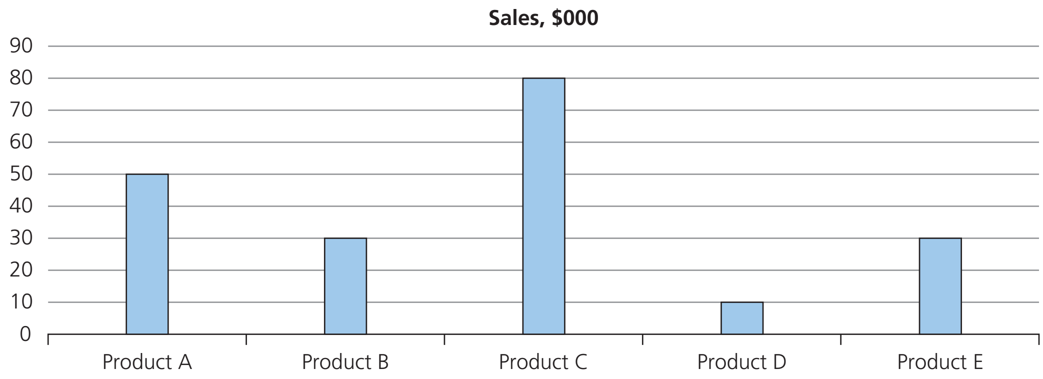


Figure BMT.6 A bar chart

Pie charts

- A **pie chart** is a type of visual diagram that displays processed data in the form of a circular graph.
- It is particularly useful for displaying data in proportions or percentages that add up to 100 per cent of the items in the data set being represented.
- A pie chart is divided into segments, with the size of each segment being proportional to the quantity it represents from the data set.

- In business management, pie charts are often used to display data such as market share, sales revenue by product or location, cost and revenue data, customer demographics, or any other metrics used to gauge customer preferences. The pie charts can then be used by managers to make decisions accordingly.
- When dealing with a large number of categories, it can be challenging to represent the segments using a pie chart. In such cases, a bar chart might be more appropriate.

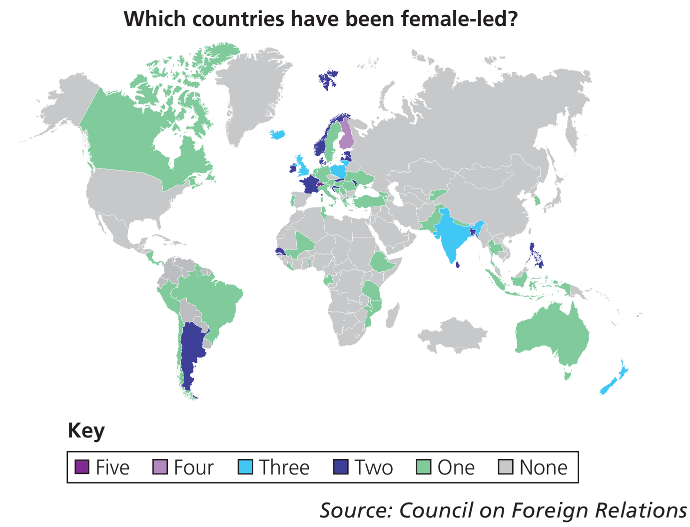
EXAM PRACTICE QUESTION

Use the following data from a school to create a pie chart to represent the percentage of candidates who opt to write an extended essay based on each IB subject group. [4]

IB Subject Group (EE)	Percentage
Group 1	20
Group 2	10
Group 3	45
Group 4	15
Group 5	5
Group 6	5

Infographics

- An **infographic** is a visual tool used to represent data by combining information (text) and graphics (images).
- Infographics are designed to make complex information and data easier to interpret and understand.
- As a form of descriptive statistics, infographics use visual tools to summarize and convey key insights and findings about a specific topic or data set.
- They can be used to present data in a variety of formats, including charts, graphs, diagrams, timelines, flowcharts, maps, and coloured illustrations.
- Infographics are more engaging and accessible as a form of communication to a wide audience.



■ **Figure BMT.7** An example of an infographic, showing the number of elected/appointed female heads of government/state* by country since 1946

*As of Jan 2023. Excludes monarchs or those appointed by them

Quartiles

- A **quartile** divides the data collected in a data set (such as sales revenue for a given period of time) into four parts, in order to facilitate statistical analysis and business decision making.
- Quartiles split the data into four, in the same way that the median splits the data into two.
- Note that three quartiles are used to divide the data set into equal parts, or quarters (see Figure BMT.8). The three quartiles are known as the:
  - first quartile (Q1) or the 25th percentile – the bottom 25 per cent of the values in the data set appear to the left of Q1
  - second quartile (Q2) or the 50th percentile – the middle range in the data set appear to the left and right of Q2 (which is also the median value of the data)

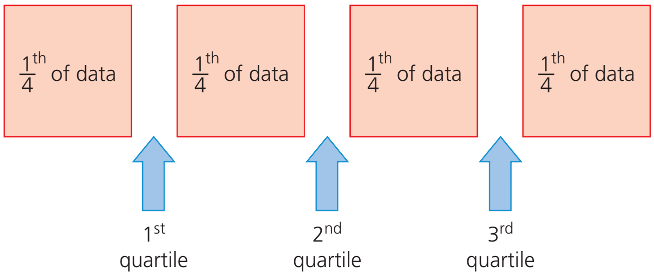


Figure BMT.8 Quartiles

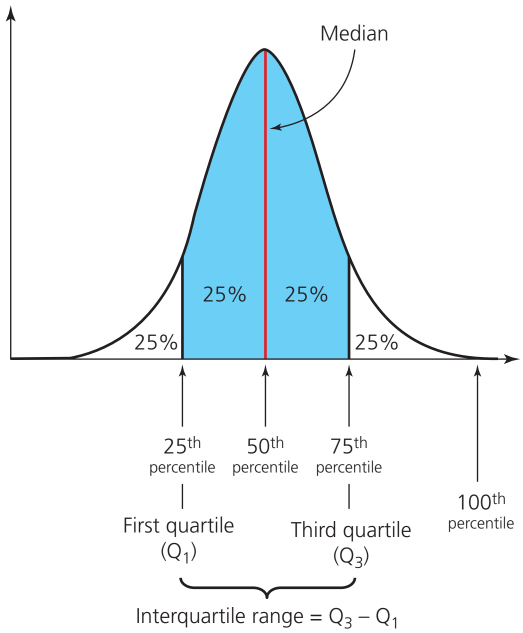


Figure BMT.9 The interquartile range

   ○ third quartile (Q3) or the 75th percentile – the top 25 per cent of the values in the data set appear to the right of Q3.
- Using quartiles enables managers to see the distribution of items in a data set, such as the ranking of different branches of a restaurant or retail outlet, based on the value of the sales revenue they account for.
- Figure BMT.9 shows a typical or normal distribution of the data dispersed in a data set, using quartiles.

- The **range** in a data set is a measure of variation, meaning how spread out the data are. The range is equal to the highest value minus the lowest value in a data set. However, the range is affected by extreme values (called **outliers**). To deal with this problem, statisticians use the interquartile range.
- The **interquartile range** is used to show the spread of data in a data set. It measures the difference between the first and third quartiles, thereby showing the middle spread of the data.

Interquartile range = Third quartile − First quartile

or

Interquartile range = Q3 − Q1

WORKED EXAMPLE

As an example, the following are the results of an aptitude test, marked out of 100, taken by 11 employees: 33, 97, 37, 71, 13, 77, 84, 55, 57, 27, and 94. To find the interquartile range, the following steps are taken:

- First, place the test scores in numerical order: 13, 27, 33, 37, 55, 57, 71, 77, 84, 94, and 97.
- The median value or score is 57.
- The data set has 11 items, so we can find the position of Q1 and Q3.
- The first quartile (Q1) value is 33 (there are two employees who scored less than this and two people who scored more than this in the test, but less than the median score of 57).
- The third quartile (Q3) value is 84 (there are two employees who scored higher than this and two employees who scored less than this, but higher than the median score).
- Therefore, the interquartile range is 84 – 33 = 51.
- This indicates that the values between the first and third quartiles are spread out over a large range (51 out of 100), so managers may need to consider retraining opportunities for the employees. In particular, the two employees who scored less than the 25th percentile may need additional training.

Standard deviation

- **Standard deviation** (σ) is a statistical measure of how spread out data points are within a set of data. It shows whether there is a small or large spread of results.
- A low standard deviation implies that the data items in a data set are clustered closely around the mean (average).
- Conversely, a high standard deviation indicates that the data points are spread out over a wide range, which can be caused by outliers within the data set.
- It is important to note that the standard deviation for a data set is prone to outliers. A single outlier in the data set can significantly change the standard deviation, even if the rest of the data points are clustered around the mean value.
- In general, therefore, managers prefer a low standard deviation, as this indicates more consistency within the raw data. Note that this is a reason why it can be useful to also measure the interquartile range, which is not generally sensitive to outliers.

WORKED EXAMPLE

To calculate the standard deviation, consider the data items representing the monthly sales revenue from a business that has five retail outlets.

Store	A	B	C	D	E
Sales ($'000)	120	110	130	125	115

- First, calculate the mean (average) of the data set: (120 + 110 + 130 + 125 + 115) ÷ 5 = 120.
- Next, work out the variance for each data point by subtracting the mean from the data point, then squaring the result:
  - $(120 - 120)^2 = (0)^2 = 0$
  - $(110 - 120)^2 = (-10)^2 = -100$
  - $(130 - 120)^2 = (10)^2 = 100$
  - $(125 - 120)^2 = (5)^2 = 25$
  - $(115 - 120)^2 = (-5)^2 = -25$
- Next, add all the squared differences and then divide by the number of data points: (0 + 100 + 100 + 25 + 25) = 250 ÷ 5 = 50
- Finally, calculate the square root of the result to get the standard deviation: $\sigma = \sqrt{50} = 7.07$.

EXAM PRACTICE QUESTION

The data below show the sales of five employees at a retail store.

Employee	**Sales ($'000)**
A	25
B	30
C	15
D	30
E	50

a Describe what is meant by standard deviation in a data set. [2]

b Use the data above to calculate the standard deviation. [4]