# The big picture

You may have heard the phrase, ‘If you are getting something for free, you are the product’. This may not always be the case, but your personal data is certainly a valuable resource for businesses. When you use a business’s product for free, the business is likely using your data to earn money for itself.

Businesses are able to gather, monitor, analyse and make decisions using huge amounts of information that customers provide when using technology. Businesses use the information they gather to understand consumers’ needs, wants and expectations in order to improve marketing and sales to their target markets. Often people do not even know that they are providing this data to businesses. The strategy of gathering and using personal data, with or without consumers’ knowledge, has been called ‘surveillance capitalism’.

There are serious concerns about the ethical and legal consequences of businesses gathering and analysing large amounts of data from people’s use of technology.  Businesses need to be aware of these consequences for different stakeholders when using management information systems and digital technologies.

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**Video 1.** What is surveillance capitalism?

This subtopic will explore various management information systems (MIS). These are designed to aid decision-making by collecting, collating, coordinating, controlling and channelling information within an organisation. Management information systems can be thought of as the brain of a modern business, processing information which leads to effective decision-making. You will explore the many uses of these systems and also the problems and risks associated with these new technologies.

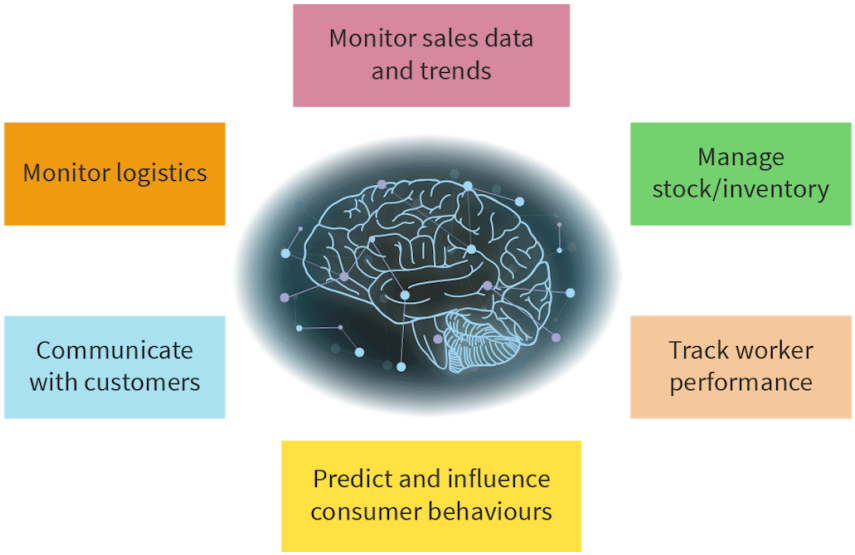


**Figure 1.** Management information systems (MIS) are the 'brains' of many modern-day organisations.

More information for figure 1

The image is a diagram showing a graphical representation of a human brain in the center, surrounded by various labeled functions of management information systems. The central brain icon symbolizes the core processing unit. Surrounding this icon are six colored rectangles, each containing a different key function: "Monitor sales data and trends" (top),

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"Monitor logistics" (left), "Communicate with customers" (bottom left), "Predict and influence consumer behaviours" (bottom), "Track worker performance" (right), and "Manage stock/inventory" (top right). This diagram visually represents the comprehensive areas management information systems cover in an organization.

[Generated by AI]

### Making connections

The Center for Humane Technology (https://www.humanetech.com) is a great resource for understanding the impact of surveillance capitalism on society. The organisation made a documentary entitled *The Social Dilemma*, which you may have seen. If you are curious about the impact of the digital technologies discussed in this subtopic, the Center for Humane Technology is a great place to start.

**Learning objectives from the IBDP Business Management guide with assessment objective level:**

- **Describe** data analytics, database, cybersecurity and cybercrime (AO1)
- **Analyse** the importance of critical infrastructures, including artificial neural networks, data centres and cloud computing (AO2)
- **Explain** the role of virtual reality (VR) in business (AO2)
- **Comment** on the importance of the internet of things, artificial intelligence and Big Data (AO2)
- **Examine** the benefits and drawbacks of customer loyalty programmes (AO3)
- **Discuss** the use of data to manage and monitor employees; Digital Taylorism (AO3)
- **Evaluate** the use of data mining to inform decision-making (AO3)
- **Examine** the benefits, risks and ethical implications of advanced computer technologies (management information systems) and technological innovation on business decision-making and stakeholders (AO3)

5. Operations management / 5.9 Management and information systems (HL)

# Critical infrastructures

Student view

Facial recognition technology is a rapidly growing industry that shows the combined power of artificial intelligence and digital technologies. Facial recognition technology is now used in all kinds of everyday situations, such as at airport passport control, in security systems, in shops and supermarkets and in profiling for marketing purposes.

**Figure 1.** Facial recognition technology in action.

Credit: Monty Rakusen, Getty Images

More information for figure 1

The image shows a group of five individuals standing in an office, facing a large monitor mounted on the wall. The monitor displays a screen related to facial recognition technology. The left side of the screen features a list containing images of faces along with data such as age, gender, and observation times. Each entry is categorized under columns that include 'Gender,' 'Distance Moved,' and 'Time.' On the right side of the monitor, there is a larger image of four faces with colorful annotations drawn around them, likely representing the real-time analysis by the software. This visual highlights how facial recognition technology works in identifying and analyzing human faces, possibly with information about the individuals' movements and expressions. The setting indicates a corporate or professional environment where such technologies are demonstrated or utilized.

[Generated by AI]

The marketing company AdMov, for example, uses tablets with facial recognition technology in a number of vehicles belonging to Grab. Grab is a multinational technology company, based in Singapore, that has a successful ride-hailing app. The facial recognition technology within these tablets can determine the age, gender and mood of the rider. It then provides each

individual rider with targeted content, specifically for them, via the tablet. The technology can even track eye movements and change advertisements when it detects a loss of interest. DeNaCo Ltd is another company that offers similar marketing services in Japan.

Facial recognition and other digital applications require critical technological infrastructure, including:



- data centres
- cloud computing
- artificial neural networks

## Databases, data analytics and data centres

A database is an organised collection of information that is stored in an electronic system. This information can be processed and filtered for a specific purpose. Data analytics refers to the science of analysing data to establish patterns, trends and behaviours in order to draw conclusions. Databases are analysed by data mining, a process of searching for and finding patterns and trends within large data sets.

**Figure 2.** Data mining helps find patterns and trends in human behaviour that can inform business strategy.

Credit: Yuichiro Chino, Getty Images

Data is very valuable for businesses. In marketing, for example, patterns and trends in human behaviour can be used to develop strategies that increase sales and profits. Links between demographic data and consumer purchases can help businesses improve market segmentation and develop more personalised marketing strategies. Data can also help businesses improve sales forecasting (Subtopic 4.3 HL (/study/app/business-hl/sid-351-cid-762729/book/the-big-picture-id-38737/)).

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In human resource management, a business may be interested in information on employee productivity. Businesses can collect and analyse how much time employees spend on certain tasks, such as the number of emails sent, or the number of products processed within a fulfilment centre.

### Making connections

Popular documentaries such as *The Great Hack* and *The Social Dilemma* have highlighted just how valuable data is for businesses. They also highlight the ethical issues faced by businesses as they gather, process, use and sell the data of their customers. If you have access to one or other of these documentaries, you may want to watch them to learn more.

As valuable as data is to businesses, there are significant ethical concerns with the wide-scale collection and mining of large databases. Concerns include:

- How much data is being collected? At what point does data collection and data mining begin to violate privacy rights?
- Do consumers know how much and what data is being collected about them and how it is being used? Have they really given permission for businesses to engage with their data?
- Who has access to this data and under what circumstances? Can the data collected by one business be sold or given to another business or organisation?
- Is the data secure?
- Is the data being used for malicious purposes?

### Activity

**Learner profile:** Knowledgeable
**Approaches to learning:** Thinking skills (transfer)

Amazon is the world's largest retail store. It has detailed records on its 59 million plus customers and businesses. This includes customer details, preferences, inventory and wish lists, as well as data collected via its many products and services. There is data collected from Amazon's e-commerce platform, Amazon web services, audiobooks, e-readers, music and video platforms, fitness trackers, home security systems and Alexa-enabled devices.

All this data is used to help Amazon build up extensive profiles of its clients, which can then be used to market products or services to them.

Imagine that you wanted to do an investigation related to how Amazon collects, processes and uses customer data.

Student view

- Consider the information in this section and develop an appropriate research (inquiry) question for this topic.
- Then develop several sub-questions that you would need to answer in order to address your main research question.
- Finally, brainstorm some ideas for primary research methods or secondary research sources you could use to get the information you need to answer your research question.

## Theory of Knowledge

Increasingly, information about people's medical conditions and medical histories are being stored in databases so that medical professionals have access to patient information when they need it. This is obviously hugely advantageous when it comes to improving medical care, particularly for example when a doctor needs to treat a patient with whom they are not familiar.

However, these databases could provide valuable information for other kinds of services too. Health insurance businesses might like to access medical information on individuals to determine insurance fees. These businesses would likely want to charge higher insurance fees to patients who have a greater risk of medical problems. Pharmaceutical companies might also be keen to access patient data in order to determine drug prices for individual consumers.

Clearly, it is more controversial for insurance and pharmaceutical companies to access and use patient information than it is for doctors to do so. This highlights the ethical issues associated with the use of personal data for business purposes.

- What are the moral implications of possessing large amounts of information about people and their behaviour? (IBDP Business Management guide)

Data centresData centres (undefined) are either buildings or sub-sections of buildings that contain servers, support computer networks and run the systems needed to provide digital technologies or services. They are an important part of the critical infrastructure that enables businesses to collect and process vast quantities of information. Without data centres, e-commerce platforms, apps, computerised systems and almost every piece of technology used today would cease to function.

However, there are significant costs associated with building, operating and keeping data centres secure. There are also sustainability issues with data centres. They consume large amounts of energy and, as more and more data needs to be stored and processed, they require constant upgrading of hardware and scale.

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# Cloud computing

Data centres make cloud computingcloud computing (undefined) possible. Cloud computing involves data storage and networking of computers, software, databases and servers. Cloud computing allows information to be stored and accessed from anywhere in the world where there is a network.

You have likely experienced cloud computing at school using virtual learning platforms. Use of these cloud computing platforms increased greatly during the COVID-19 pandemic, as schools and universities needed to deliver their services online. Many classrooms are now virtual; their resources are accessible from anywhere in the world. Teachers can stream lessons live from wherever there is an internet connection, and students can access lessons and resources from an educational institution that is located on the other side of the world. Vast amounts of data is stored within the cloud.

## Concept

### Sustainability

Environmental sustainability is a growing concern with the increasing use of technologies in business. Data centres consume very large amounts of energy. They require extensive use of rare earth metals, consume huge amounts of power (particularly electricity) and produce a vast amount of electronic waste. In some countries, such as Denmark, data centres have been built to be powered entirely by renewable energy. Whilst this reduces the environmental damage, it does not resolve the issue entirely.

## International Mindedness

Operating data centres is expensive and requires high levels of expertise. For many businesses, the cost is too high. For this reason, a number of larger companies provide data storage for the third parties. These providers include Google (https://www.google.com/about/datacenters), Amazon (https://aws.amazon.com/compliance/data-center/data-centers/)and Microsoft (https://azure.microsoft.com/en-us/global-infrastructure/), who between them own approximately half of the world's hyperscale (very large) data centres located in dozens of countries. There are also large companies outside of the United States, such as América Móvil (https://www.americamovil.com/English/overview/default.aspx), that provide data centres for others.

The market for data storage globally is concentrated, with a small handful of dominant providers.

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- Do you think that the concentration in this industry increases or reduces the concerns around ethics and sustainability?

# Artificial neural networks (ANN)

The facial recognition technology mentioned at the start of this section requires the use of deep learning. Deep learning mimics human intelligence by connecting computing systems and nodes, like the neurons of a human brain. These connections are called artificial neural networksartificial neural networks (undefined) (ANN). These networks function as sophisticated systems, with inputs, processes and outputs.

**Figure 3.** Artificial neural networks are sophisticated systems that can process information as well as, or better than, the human brain.

Credit: AF-studio, Getty Images

More information for figure 3

The image is an abstract visualization of an artificial neural network. It shows a complex, web-like structure with numerous interconnected lines and nodes, representing the connections between artificial neurons. The lines are mostly purple, blending into shades of blue against a dark background, emphasizing a sense of depth and complexity. This imagery symbolizes how artificial neural networks process information, drawing inspiration from human brain structures. The visual represents the concept of deep learning, which involves these networks functioning with inputs, processes, and outputs, akin to human neural processes.

[Generated by AI]

Large quantities of data are gathered by management technology systems. These inputs (data) are used to train algorithms. An algorithm is a set of instructions to solve a problem or complete a task. With your (or other) data input into an algorithm, a computer system can make an appropriate decision or action (output).

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These computer systems can spot patterns and trends in data, which they can use to make decisions better and faster than human beings can. This capability can support many business functions. Financial services such as banking use these systems to automate loan applications, for example, because they can quickly calculate risk based on a borrower's characteristics.

Operations and human resources use ANNs too. You may have seen or used a chatbot to get customer service. These services can provide 24-hour customer service for most common customer requests. ANNs can also track patterns in sales and stocks (inventory) to better manage inventory. In human resources, these systems monitor staff performance, measuring time spent on projects, on emails or away from the computer, and using data analysis to appraise workers.


**Figure 4.** Chatbots are frequently used on websites to provide fast customer service.

Credit: Blue Planet Studio, Getty Images

In marketing, ANNs are being used to:

- predict and influence consumer behaviours
- automate marketing services
- create and target content such as music, film, and TV streaming suggestions and relevant social media content
- forecast sales trends
- personalise marketing

Alibaba's e-commerce platform, for example, is changing the shopping experience for consumers. ANNs provide more precise search engine results that showcase personalised goods and services by providing personalised virtual storefronts and targeted internet advertising based on a customer's user profile. In addition, products are delivered in hours rather than days, and chatbots resolve specific customer complaints without any need for human interaction.

Student view

ANNs are also being used in smart factories to improve manufacturing processes. Artificial neural networks can even teach themselves using data input, in the way that a human brain does, so that the decisions and actions of the ANNs and their algorithms improve results over time.

### Concept

Social scientists have raised ethical concerns about artificial neural networks. For example, the algorithms behind Google's YouTube recommendations are designed to keep users' attention for as long as possible.

These systems are incredibly effective, manipulating users to stay on their screens, leading to addiction and exposure to extremist views designed to keep the viewer hooked. In addition, social media platforms have come under pressure for not managing the swarms of bots that regularly spread misinformation or harmful content.

# Cybersecurity

Data is extremely valuable and the loss or theft of data is a major concern of businesses that collect and store data.

Cybercrime refers to criminal activity carried out using computers, networks and digital technologies. It is estimated that cybercrime will cost businesses more than 10 trillion USD by 2025 (https://cybersecurityventures.com/cybersecurity-almanac-2022/). Most cybercrime either takes place on or ends up on the 'dark web'. The dark web is a world wide web network accessed via specialist encrypted web browsers that keep users largely anonymous. This is therefore a place where criminal activity, such as selling stolen data, may take place.

**Figure 5.** Businesses must protect the data they collect and store.

Credit: MF3d, Getty Images

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CybersecurityCybersecurity (undefined) involves the use of technologies and systems designed to block access to technology systems by criminals. Cybersecurity is used to protect against:

- **Hacking.** This refers to exploiting weaknesses in computer systems and networks to gain access to data.
- **Ransomware.** This is software planted on a computer system designed to block access to those systems until a sum of money is paid. In 2021, the Taiwanese electronics company Acer was attacked, with hackers demanding 50 million USD. Businesses of all kinds, including critical services such as hospitals and government offices, have been hit by ransomware attacks.
- **Distributed denial of service (DDoS) attacks.** This is an attack on a computer system designed to slow down website traffic by overwhelming it with activity. In 2021, Yandex, Russia's largest search engine and internet service provider was hit with a DDoS attack and Amazon's web services platform also reported a significant DDoS attack. Both attacks were successfully repelled by cybersecurity.

Cybercrime is a major threat to both private consumers and business operations. Consumers are harmed by cybercrime when their financial or personal data is lost or taken. A person's identity can be stolen, reputations and finances can be ruined and lives can even be put at risk when essential health, energy or emergency systems are compromised by cybercrime. And businesses can lose valuable data and intellectual property (IP) as a result of cybercrime. When a business's services are disrupted, revenue can be lost and costs of cybersecurity increase. A business's reputation can be permanently damaged by poor data security.

### Making connections

In 2016, Yahoo suffered what is still considered to be one of the largest data breaches ever. Over 500 million accounts were stolen in one breach and another 3 billion customer accounts were compromised in another breach shortly afterwards.

HL Subtopic 5.7 (/study/app/business-hl/sid-351-cid-762729/book/the-big-picture-id-39527/) on crisis management and contingency planning is about how businesses deal with crises. A large data breach, or a ransomware or DDoS attack, is considered a crisis that needs to be managed well to avoid significant harm to consumers and damage to the business's reputation.

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# Evaluation of critical data infrastructure

Management information systems rely on data gathering, storing and processing. These functions of critical data infrastructure have a number of uses and limitations for businesses, which are summarised in **Table 1**.

**Table 1.** Uses and limitations of critical data infrastructure.

| Uses of critical data infrastructure | Limitations of critical data infrastructure |
|---|---|
| **Profits.** Access to large amounts of data on consumers, and on the business itself, can increase revenues and lower costs, increasing profits.<br><br>The costs of cloud computing can be lower than the costs of in-house data storage. | **Cost.** Data collection, data storage, data mining, data centres and cloud computing services are costly to run and maintain.<br><br>Businesses need hardware and software to access and use stored data, whether on-site or in the cloud. |
| **Consumer satisfaction.** Access to large amounts of data can help businesses to meet customer needs and expectations. | **Consumer manipulation.** Having access to large amounts of data enables businesses to influence consumer attention, leading them to buy things they do not need and leading to excessive use of technological devices. |
| **Sustainability.** Access to large amounts of data can help businesses avoid waste in production.<br><br>Using cloud computing reduces the need to build data infrastructure for each individual business, reducing resource use. | **Sustainability.** Data centres consume large amounts of energy, and the hardware needs to be upgraded frequently, requiring mining and plastics and contributing to e-waste. |
| **Security.** Data storage with large companies providing cloud computing services is likely to be more secure than individual inhouse data storage; larger companies will also have more robust back-up data in case of system failure. | **Ethical and legal concerns.** Storing and using customer data can violate privacy and raises ethics issues, especially where customers do not know what data is being gathered about them and how it is being used.<br><br>Complying with frequently changing privacy and security laws in different countries can be difficult for businesses that operate across borders. |

Non-profit social enterprises and for-profit social enterprisesfor-profit social enterprises (undefined) may deal with critical data infrastructures differently from for-profit commercial enterprises. They are likely to give more weight to ethical concerns and are less likely to use data to exploit consumers for commercial gain. They are also more likely to use databases and

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data analytics to meet a genuine human need or solve a real problem, whereas for-profit commercial enterprises may use data mining purely for their own profit objectives, regardless of its contribution to society. Thus, social enterprises are likely to weigh up the uses and limitations of critical data infrastructures differently than for-profit commercial enterprises when faced with choices about collecting, storing and processing data.

## Activity

**Learner profile:** Inquirers
**Approaches to learning:** Thinking skills (transfer)

There are several interesting activities related to critical data infrastructures that you could undertake.

- Invite the head of IT to your Business Management class to talk about how the school collects, stores and processes information about students. Before they arrive, identify some questions related to the content presented in this section that you could ask them.
- Research a recent news story about data collection, data storage or data processing in business. This could, for example, be about an innovation that is improving marketing, finance, human resource management or operations. Or it could be a scandal involving mishandling of data.

  Share your story with a partner or with the class.

## Activity

**Learner profile:** Open minded
**Approaches to learning:** Thinking skills (critical thinking)

Hacking receives a lot of negative media attention. It is true that many hacking incidents are malicious and destructive.

However, there are a number of interesting questions we can ask about hacking.

- What exactly is hacking? Is it possible to draw a clear line?
- Is hacking always unethical? Under what circumstances might it be justified?
- When a hacking incident occurs, how much responsibility should a business bear for it?

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# 5 section questions

**Question 1**

What is the term used to describe the process of interpreting data to establish patterns or trends?

Data analysis ✓

**Accepted answers**

Data analysis

**Explanation**

Data analysis involves understanding or making sense of a variety of data points in order to make decisions based on the data or information available.

**Question 2**

The organised collection of information on a computer system is known as a:

1 Database ✓

2 Data point

3 Data cave

4 Data set

**Explanation**

A database is a system that stores the vast collection of data that businesses gather about their consumers. Databases store data sets that can then be used for analysis purposes.

**Question 3**

What is the term used to mean the buildings that house and run servers and support computer networks?

Data centres ✓

**Accepted answers**

Data centres

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**Also accepted**
Data centers, data centre, data center

**Explanation**
A data centre is a form of critical infrastructure necessary to ensure digital systems and technologies run efficiently. Data centres have vast collections of hardware and software operating 24 hours a day to maintain websites or digital platforms for organisations.

**Question 4**

The following are all benefits of artificial neural networks (ANN) **except**?

1 They do not require any hardware. ✓

2 They can identify patterns.

3 They can make predictions.

4 They can automate tasks.

**Explanation**
Artificial neural networks (ANN) require complex, sophisticated hardware to function accordingly. They are able to connect together different subsets of data and information, making sense of complex data, identifying patterns. This then enables the system to make predictions and/or automate tasks and processes.

**Question 5**

Remote servers connected via a network to store and manage data are known as:

1 Cloud computing systems ✓

2 Data mining processes

3 Data analytics systems

4 Artificial neural networks

**Explanation**
Cloud computing systems operate remotely using a network (normally via the internet) to provide a place to store information, data and resources, which can be accessed from anywhere.

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# Virtual reality and the metaverse

Virtual reality (HL) Advanced computer technologies (HL)

When Mark Zuckerberg rebranded Facebook as Meta in 2021, he was embracing the next step in the evolution of the internet. The metaversemetaverse (undefined)metaverse refers to digital worlds in which people can work, play and gather together. The metaverse provides an expanding market for gaming, shopping, digital art and currency, and even for virtual real estate and leisure. You may recall from Section 5.8.4 (/study/app/business-hl/sid-351-cid-762729/book/innovation-incremental-and-disruptive-id-39506/) that disruptive innovation disruptive innovation (undefined)disruptive innovation involves the creation of new industries or markets. This is certainly the case with the metaverse.

The metaverse can be accessed through virtual reality (VR)virtual reality (VR) (undefined)virtual reality (VR). Virtual reality is the use of computer technologies to create a simulated 3D experience. Users can interact with the simulations using specifically designed hardware and software, such as the headsets in **Figure 1.** VR can be used to recreate or distort real world environments, processes or events. VR is not a new concept, but demand for VR-related technologies is increasing.

**Figure 1.** Demand for virtual reality experiences is increasing.

Credit: FG Trade, Getty Images

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There are many businesses and even countries moving into the metaverse. The Barbadian ministry of foreign affairs is planning to declare virtual real estate a part of its sovereign territory. HSBC and PWC are investing in digital real estate via The Sandbox. And in the African metaverse, MTN has bought virtual land in Ubuntuland. Even rapper Snoop Dogg has invested in the development of a real estate company within The Sandbox metaverse.

# Uses of virtual reality in business

## Marketing

In their marketing function, businesses are developing creative, innovative products and processes in and for the metaverse, which are designed to engage their target marketstarget markets (undefined)target markets, extend the product life cycleproduct life cycle (undefined)product life cycle of existing products and open up new markets. Customers at IKEA can use VR to virtually place products in their homes. Toms Shoes takes customers on VR trips to the communities where they make their shoe donations. Some retailers use VR to let customers try clothes, make-up and other products before they buy them. **Video 1** shows that even restaurants can use VR to enhance the dining experience.


**Video 1.** An immersive dining experience created using virtual reality.

## Operations management

In operations management, VR enables new product and process innovations (Section 5.8.4 (/study/app/business-hl/sid-351-cid-762729/book/innovation-incremental-and-disruptive-id-39506/)). For example, design engineers are able to model prototypes using simulations with

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VR software. This helps to minimise errors at the earliest stages of product development and also helps development teams to adapt designs and test products in a virtual world.

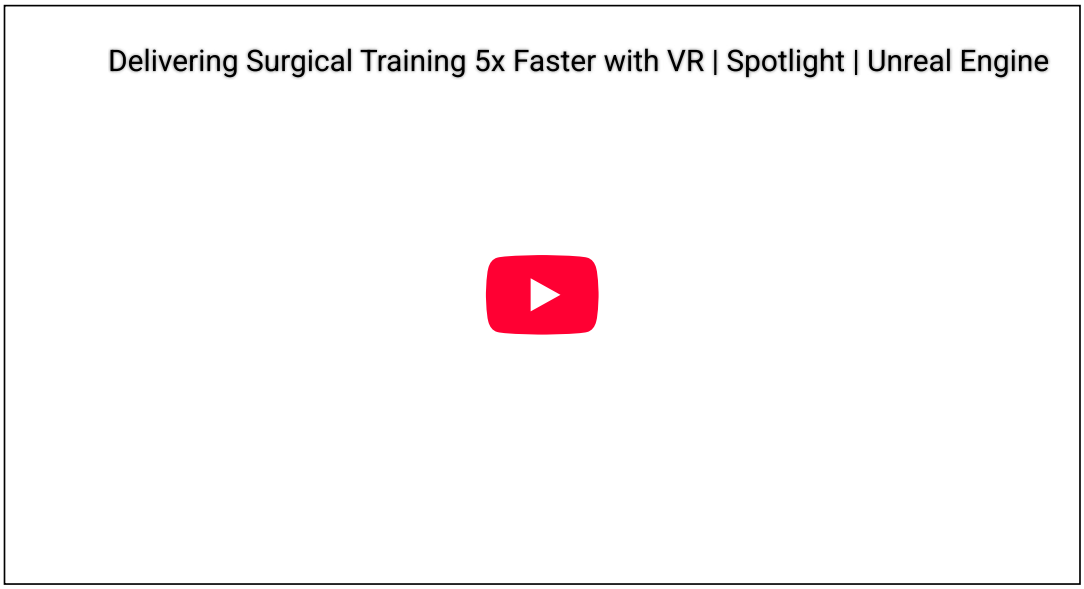
In Thailand, smart factories are using VR and 5G technology for factory tours, allowing investors, business owners, customers, employees and engineers to explore factories safely and securely without risks.

**Figure 2.** Virtual reality can be used in architecture and product design.

Credit: Georgijevic, Getty Images

## Human resource management

In human resource management, businesses are using VR to train employees more effectively. By immersing trainees in a virtual world, a more realistic training experience can be provided. Trainees can also make mistakes without harming others or the business. **Video 2** shows how VR is helping surgeons learn surgical processes without putting patients at risk.

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**Video 2.** Using virtual reality to help train surgeons.

### Concept

Creativity involves generating new ideas and considering existing ideas from new perspectives. Creativity may be evident in the use of inputs, business processes and product outputs and other solutions. The creation of ideas and solutions involves a process of synthesising and evaluating in response to surrounding changes.

Virtual reality (VR) offers businesses creative ways to engage customers, train employees and produce their products. The availability of new hardware and software technologies stimulates new thinking about how to carry out the human resources, marketing and operations management functions.

## Limitations of virtual reality

Virtual reality has a number of limitations. Firstly, depending on how they are used, VR technologies can be expensive for businesses to use. Businesses that develop products related to the metaverse need to consider the cost to the consumer of hardware needed to access the products. However, the costs of the technologies are coming down over time. Secondly, there is an issue with the clunkiness of the VR headsets used to access many virtual reality applications. While these have reduced in size and weight over time, they are still awkward for consumers to use. Related to this is the lack of accuracy and reality in some applications; the promise of truly immersive and realistic experiences has not yet been fully realised.

A third set of limitations concerns ethical issues, security-related issues and legal issues associated with VR and the metaverse. As you learned in Section 4.1.2 (/study/app/business-hl/sid-351-cid-762729/book/market-product-orientation-id-37437/), there are ethical concerns that people may lose their ability to interact with the physical world if they spend too much time in the metaverse. In addition, as people interact in the digital world and data is collected about what they do there, there are the same concerns mentioned in Section 5.9.1 (/study/app/business-hl/sid-351-cid-762729/book/critical-infrastructures-id-39509/) about data/privacy protection and data security, and about meeting legal obligations across real and metaverse country borders.

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Non-profit social enterprises and for-profit social enterprises may deal with the limitations of VR differently from for-profit commercial enterprises. Social enterprises are likely to give more weight to ethical concerns and are less likely to use VR to exploit consumers for commercial

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gain. They are also more likely to use VR to meet a genuine human need or solve a real problem, whereas for-profit commercial enterprises may use the technology purely for their own profit objectives regardless of its contribution to society.

## Case study

Conservation International is a non-profit social enterprise. The organisation aims to empower societies to care for nature.

The company has developed a new innovation that it hopes will stimulate interest in its nature conservation work. In partnership with VR production company Vision3, Conservation International has developed a new virtual reality experience (https://www.conservation.org/stories/virtual-reality/my-africa)whereby participants can explore a photorealistic environment, interacting with and caring for baby elephants. The strategy aims to educate the audience, improve awareness and increase donations for the local communities undertaking conservation work.

Many social enterprises are developing creative methods to engage their stakeholders to improve social and environmental sustainability. In this case, this is being done through community-based conservation measures.

**Questions**

1. Define virtual reality (VR). [2 marks]
2. Explain **two** uses of VR for Conservation International. [4 marks]

**Question 1**

Virtual reality is the use of computer technologies to create a simulated 3D experience. Users can interact with the simulations using specifically designed hardware and software.

**Define** is an AO1 level command term, requiring the precise meaning of a term.

- One mark is given for a vague definition.
- Two marks are given for a complete definition.
- Definitions do not require application to the stimulus material.

**Question 2**

Virtual reality can enable businesses and other organisations to engage with key stakeholders, including customers or donors. Non-profit social enterprises such as Conservation International can use virtual reality experiences to help potential donors understand the work they do and engage them emotionally. This can improve education and awareness and increase donations to the organisation to support local conservation.

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In addition, virtual reality can offer a competitive advantage for businesses and other organisations. Virtual reality is still a niche area for organisations; providing a virtual reality experience for customers or donors could help to differentiate products. In this case, VR could help Conservation International to differentiate their project from rival social enterprises. This could give Conservation International a unique selling point (USP) that enables them to stand out, and increases the number of potential donors and engagement.

**Explain** is an AO2 level command term, requiring a detailed account including reasons or causes. Explain *why*, explain *how*.

- Only two uses of VR need to be explained. Other responses are possible and would be rewarded if appropriate.
- To achieve full marks, you must always include theory and application to the case study in your responses to the **explain** command term.

### Exam tip

Remember that HL includes a third paper (Paper 3) based upon a social enterprise. Therefore, it is important that you understand the role of these organisations in supporting communities.

It is also important to understand the role technology and innovation can play in supporting social enterprise projects and engaging key stakeholders. Technology provides creative ways to engage with stakeholders, scale operations and secure the necessary finance to support non-profit and/or for-profit social enterprises.

## 3 section questions

**Question 1**

1 Virtual reality ✓ is a computerised simulation of a world using specialised hardware.

Student view

**Accepted answers and explanation**

#1 Virtual reality

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VR

**General explanation**

Virtual reality uses specialist hardware to access digital worlds or simulations.

**Question 2**

Which of the following is **not** a benefit of virtual reality?

1 Fragmented market ✓

2 Consumer engagement

3 Unique selling point (USP)

4 Training opportunities

## Explanation

Virtual reality is still a fragmented market. The technology and the software are still quite niche and customised to very specific needs. This means that the market is still fragmented and it is difficult to scale up the usage.

**Question 3**

Which of the following elements of the marketing mix may be affected when virtual reality is used in retail to improve customer experience in the store?

1 Process ✓

2 Price

3 Placement

4 People

## Explanation

Process refers to the manner and efficiency in which a product or service is delivered. Virtual reality can make the process of buying a product more seamless. Customers can use virtual reality to help identify whether a product is able to meet their needs by experiencing it first within a virtual world.

Student view

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5. Operations management / 5.9 Management and information systems (HL)

# The internet of things, artificial intelligence and big data

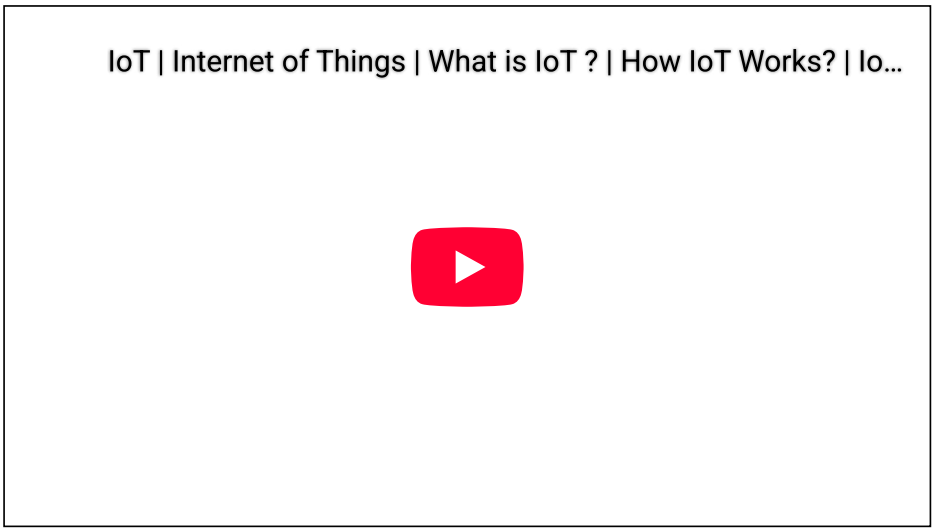
The internet of things (HL) Artificial intelligence (HL) Big data (HL) Data mining (HL) Advanced computer technologies (HL)

Another area of disruptive innovation involves the increasing connectivity between objects in the physical environment. This connectivity, combined with the data generated and artificial neural networks that you learned about in Section 5.9.1 (/study/app/business-hl/sid-351-cid-762729/book/critical-infrastructures-id-39509/), opens new markets and industries.

## The internet of things (IoT)

The internet of things (IoT) (undefined)internet of things (IoT) (undefined) describes connections (networks) of physical objects using software that enables them to communicate and exchange data. These are sometimes called 'smart' devices or systems.

You may have a smartphone, a smart TV, a smart speaker, a smart home device, a smart security camera or a smart watch. Some homes have a robot vacuum, a smart temperature meter and smart light bulbs. As smart systems become more sophisticated and integrated, smart appliances, smart clothing and many other smart technologies – including autonomous vehicles and systems – will connect together. Smart cities are already using technologies to increase connectivity in order to share data to improve city systems including transportation, energy, waste management and others.




**Video 1.** What is the internet of things?

Student view

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Another example of the internet of things is in the world of sport. Sports technology companies are installing chips, sensors and other devices into footwear, clothing, watches and equipment. The aim of this is to help coaches monitor athlete performance and health (by using data analytics to improve training), enhance diets and personalise coaching to improve individual output. This is opening up new markets for sportswear and sports science. All of this data can be accessed from smartphones or tablets at any time to help coaches make effective real-time decisions on the performance of athletes. By enabling every tiny detail of an athlete's performance to be tracked and monitored, this technology is being used to improve in-game techniques.

## Artificial intelligence

Artificial intelligence is the ability of a computer-controlled robot, or autonomous robot, to carry out tasks previously carried out by humans. In manufacturing, sensors and robots work in synchronicity with machines to produce goods in an automated factory, known as a smart factory. With the right programming, machines can even improve their own functioning over time. Machine learning is a type of artificial intelligence that uses data and algorithms to improve processes and outputs over time.

Artificial intelligence is changing the way in which business is conducted, in every sector. **Table 1** outlines a few examples of artificial intelligence in the primary, secondary and tertiary sectors.

**Table 1.** Examples of the benefits of artificial intelligence in different sectors.

| Sector | | Examples of benefits of AI |
|---|---|---|
| **Primary sector** |  Credit: Bunlue Nantaprom / EyeEm, Getty Images | • Increases efficiency of food production through precise monitoring and application of nutrients, reducing pesticide and water use and improving sustainability.<br>• Drones can closely monitor crops and soil and can also track livestock. |

Student view

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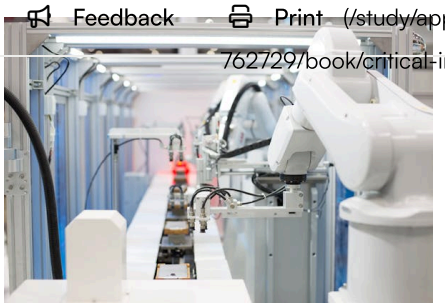
| Sector | | Examples of benefits of AI |
|---|---|---|
| **Secondary sector** |  Credit: gong hangxu, Getty Images | • Minimises waste and identifies defects, improving lean production.<br>• Factory data is stored in the cloud and machine learning corrects problems and improves efficiency.<br>• Factories operate with little human intervention, reducing costs of labour. |
| **Tertiary sector** |  Credit: Ekkasit Keatsirikul / EyeEm, Getty Images | • Robots and sensors monitor consumer behaviour and engagement, improving sales forecasting, pricing decisions, product placement and customer segmentation.<br>• Sensors and cameras monitor stocks (inventory) so that reorders are made automatically.<br>• Sensors and cameras monitor stores and automatically calculate purchases in a consumer's cart, charging the customer's card as they leave the store.<br>• Chatbots provide 24-hour customer service, reducing the need for human labour. |

Section Student... (0/0) Feedback Print (/study/app/business-hl/sid-351-cid-762729/book/critical-infrastructures-id-39509/print/) Assign

Section Student... (0/0) Feedback Print (/study/app/business-hl/sid-351-cid-762729/book/virtual-reality-and-the-metaverse-id-39510/print/) Assign

More information

A person is holding a tablet while standing in a supermarket aisle. The tablet screen displays multiple bar graphs. The titles of the graphs are partially visible, such as 'First Category...', 'Second Category...', followed by bar graphs showing percentage values: 70%, 74%, 45%, and 24%. Below the graphs, there is a small bar chart labeled 'No. of Items per Category' showing three different bars marked as Low, Medium, and High. The aisle is stocked with various grocery items, indicating it's a supermarket.

[Generated by AI]

Student view

Whilst the capabilities of artificial intelligence vary by sector and business, generally AI can:

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- improve decision-making with use of production, stock, sales and customer data
- automate processes to ensure speed, consistency and efficiency
- develop new markets through innovations and capabilities
- provide virtual assistance for customer service and other areas

### Theory of Knowledge

Artificial intelligence analyses large data sets to identify patterns and trends and then takes action based on that knowledge. Until recently, this is something that has only been done by human beings. Knowledge is usually associated with human beings, so a question arises as to what extent the processes of artificial intelligence mean knowledge is now stored outside of human beings.

- Does artificial intelligence allow knowledge to reside outside of human knowers?

# Big data

Big data refers to large amounts of data collected by advanced technologies. The volume and variety of data gathered is impossible for human beings to process; the analysis and processing of this data is only possible with machines.

The more data these systems process, the more they can improve decision-making for businesses. Through the internet of things, connected devices communicate more and more, enabling systems to adapt and tailor their capabilities. This results in improved decision-making and more streamlined production processes. This in turn leads to higher returns on capital investment, more targeted promotions, increased customer engagement and development of new products and services.

### Making connections

You could use a variety of business tools when considering a business decision to implement machines with artificial intelligence.

A decision tree, force field analysis, investment appraisal or the Ansoff matrix may help you to assess the benefits and drawbacks of adopting such technology.

Student view

Deep learning is a more sophisticated version of machine learning and also uses big data to improve outcomes. It relies on the use of artificial neural networks (ANN) introduced in Section 5.9.1 (/study/app/business-hl/sid-351-cid-762729/book/critical-infrastructures-id-39509/). This is

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the technology that enables self-driving vehicles to make steering, speed, and braking decisions based on information from a context that changes second-by-second. The same algorithms are being used to develop sophisticated robotic assistants that can manage emails, calendars or small tasks, or which can help provide assistance around the home or in retail settings.

Deep learning technologies are also helping to provide advancements in cyber security, health care, catering, deep-sea exploration and automotive and logistics industries, to name a few. It is causing disruptive change across many industries.

## Risks associated with the internet of things, artificial intelligence and big data

It is important to consider that all of these elements– the internet of things, artificial intelligence and big data – work collectively and have risks and limitations associated with them, some of which are outlined in **Table 2**.

**Table 2.** Risks associated with the IoT, AI and big data.

| Technology | Risks and limitations |
|---|---|
| Internet of things (IoT) | **Cybersecurity.** DDoS attacks, malware, ransomware and hackers threaten the security of connected devices and systems.<br><br>**Poor internet infrastructure.** This reduces connectivity and limits sensor effectiveness, especially in countries that lack 4G and 5G networks. |
| Artificial intelligence (AI) | **Capital costs.** AI technologies, especially if needed on a large scale, can be very expensive, at least initially.<br><br>**Ethics concerns.** Poor algorithm programming can lead to discrimination and bad decisions, privacy violations and job losses.<br><br>**Legal concerns.** Laws still lack clarity on liability when AI malfunctions; legal privacy protections are lagging behind advancements in technology. |
| Big data | **Security.** Storing vast amounts of data increases risk of loss or of theft from cybercriminals.<br><br>**Costs.** Data centres, cloud computing and cybersecurity add costs to a business's operations.<br><br>**Ethics concerns.** Collecting, storing and processing data can lead to privacy violations; data can be used to manipulate consumer behaviour or to discriminate against certain groups. |

Student view

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## Concept

### Change

Disruptive innovations such as virtual reality, the internet of things, artificial intelligence and big data are changing industries. As a result, many new businesses are emerging that deliver goods and services with these technologies. Some existing businesses are adapting their models to use these new technologies; other businesses are finding that they cannot adapt and go out of business. Thus, technological change is a key element of the external environment (Section 1.1.5 (/study/app/business-hl/sid-351-cid-762729/book/tool-swotsteeple-analysis-id-36504/) STEEPLE) that affects business operations.

## Activity

**Learner profile:** Principled
**Approaches to learning:** Thinking skills (critical thinking)

**Video 2** addresses some pros and cons of artificial intelligence in various contexts. The full video is about 42 minutes long, but is divided into four sections as follows:

1. AI in medicine (0:00-15:05)
2. AI in China (15:05-23:00)
3. AI and the power of big technology companies (23:00-30:40)
4. AI and self-driving cars (30:40-42:25)

Each section mentions some benefits of AI, but also highlights some ethical issues.

**Video 2.** How is AI used and what are the ethical risks?

- In a small group or alone, watch one of the four sections of **Video 2**.

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- With your group members or alone, develop an inquiry question related to the ethical issue(s) outlined in that section of the video.
- Identify the key stakeholders involved in the AI application and list their main interests.
- Share your work with other students who developed ethics inquiry questions for the other video sections. Do any of the questions overlap? Are there any ethics themes that arise from these questions?

## 3 section questions

Student view

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**Question 1**

What is the term that means the connection of physical objects through a network?

internet of things ✓

**Accepted answers**

internet of things

**Also accepted**

the internet of things, IoT, the IoT, internet of things (IoT), the internet of things (IoT)

**Explanation**

The internet of things (IoT) brings together different smart technologies, communicating and distributing data. This enables different objects to speak to each other, sharing data and information.

**Question 2**

1 Artificial intell... ✓ is a computer system that is able to perform tasks normally carried out by humans.

**Accepted answers and explanation**

#1 Artificial intelligence

**General explanation**

Artificial intelligence (AI) makes use of computerised robots or autonomous systems, which are able to carry out a range of tasks previously only carried out by humans. For example, robots now complete processes on an assembly line.

**Question 3**

Which of the following is **not** a risk or limitation associated with artificial intelligence (AI)?

1 AI will never be able to surpass the human brain in terms of processing information. ✓

2 Legal privacy protections lag behind technology advancements, making the situation uncertain for businesses and consumers using AI.

3 AI may result in large job losses in certain industries, reducing incomes and human wellbeing.

4 Poor algorithm programming can lead to bad decisions and discrimination.

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**Explanation**

Legal protections for privacy, job losses and poor algorithm programming are all risks and limitations associated with AI. However, it is already the case that AI has surpassed human brain processing power in a number of areas, so this is **not** a limitation.



# Customer loyalty programmes

Customer loyalty programmes (HL) Data mining (HL) Advanced computer technologies (HL)

Do you have a favourite business – maybe a supermarket, restaurant or museum – that you go to again and again? Those businesses rely on your repeated purchases and want to keep you as a customer. Customer loyalty is an extremely valuable asset for a business. It is easier, less time-consuming and less costly for businesses to retain existing customers than it is for them to replace leaving customers or acquire new customers. Customer loyalty is essential for business revenues.

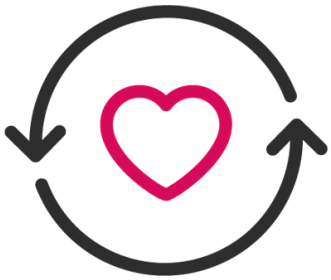

**Figure 1.** Building customer loyalty ensures repeat business.

## Uses of consumer loyalty programmes

A customer loyalty programme (undefined) rewards customers that repeatedly purchase products from a business. Loyalty programmes can be as simple as a paper card that gets stamped with each purchase. An ice cream parlour, for example, could stamp a customer's card with every ice cream purchase that the customer makes, and provide that customer with a free ice cream after 10 purchases.

New technologies enable even more sophisticated loyalty programmes. Using a card or an app, businesses can collect data about consumers and their purchases. This data can then be analysed and used to target customers through below the line promotion (undefined) or

Student view

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rewards that are personalised to their tastes and preferences. You may have seen such programmes in action at a supermarket or restaurant. Hotels and airlines usually have such loyalty programmes in place because they are especially reliant on repeat business.


**Figure 2.** Customer loyalty programmes provide rewards for repeat purchases.

Credit: andresr, Getty Images

Digitalisation has improved the efficiency of customer loyalty programmes. The mining of data and data analytics enable businesses to make more accurate sales forecasts from consumer buying patterns. They can also be used to analyse the effectiveness of different promotional strategies to improve marketing. Loyalty programmes can become an essential part of the marketing plan (undefined) (Subtopic 4.2 (/study/app/business-hl/sid-351-cid-762729/book/the-big-picture-id-37443/)).

## Limitations and risks of consumer loyalty programmes

Loyalty programmes are not guaranteed to work, however, and may not always be appropriate. Many businesses cannot afford sophisticated loyalty programmes. And for companies that do not see much repeat business, a loyalty programme would not be very useful for driving sales. Also, because so many businesses now offer loyalty programmes, providing such a programme may not always be an effective way for a company to differentiate itself from its competitors.

Furthermore, the interpretation and use of customer loyalty data has created some ethical concerns. Loyalty cards support consumer profiling, so the data collected may influence the types of products or services available to certain consumers. For example, businesses could use the data to charge different consumers different prices for goods and services, as commonly

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occurs in the air travel industry. While this practice does not always raise ethical alarms, other uses of data for offers are more problematic. Supermarkets, for example, could use data from customer loyalty programmes to promote unhealthy foods to consumers who have shown a willingness to buy such products in the past. Promotions could entice some customers to buy products they do not need.

In general, as you learned in Section 5.9.1 (/study/app/business-hl/sid-351-cid-762729/book/critical-infrastructures-id-39509/), the collection, storage and processing of people's data raises significant ethical concerns. While the data could improve consumer satisfaction and business revenues, there are dangers related to consumer manipulation, privacy and security.

### Theory of Knowledge

Consider the kind of purchasing data that is gathered through customer loyalty programmes and how that data is used to convince customers to continue purchasing products from a business, or to promote other products that the business wants the consumer to buy.

- How might prejudices, biases and inequality become 'coded into' customer loyalty programmes? (IBDP Business Management guide)

### Case study

Checkers Sixty60 is the number one grocery app in South Africa. The app is popular because it provides a convenient and speedy delivery service. The company also now uses the Shoprite Xtra Savings loyalty reward scheme, one of the fastest growing reward schemes in South Africa.

The integration of the Sixty60 app with the Shoprite Xtra Savings card is designed to make it more convenient to save on groceries. By linking the two systems, shoppers using the Sixty60 app can benefit from personalised deals and promotions.

The Shoprite Xtra Savings programme provides customers with discounts up to 40% and can be used across all of the Shoprite groups stores. This customer loyalty programme now has over 22 million members.

The loyalty programme is popular with customers across South Africa, offering plenty of savings for customers. A spokesperson for Checkers Sixty60 stated that 'the loyalty programme, combined with online shopping, provides detailed customer data, enabling targeted promotions that are unique to customers ... improving customer experience'.

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Shoprite has also launched a mobile network called K'nect, which offers rewards such as free airtime and data for Shoprite customers as well as extra rewards for Shoprite Xtra members.

**Questions**

1. Define customer loyalty programme. [2 marks]

2. Analyse **two** benefits for Checkers Sixty60 of using a customer loyalty programme. [4 marks]

A customer loyalty programme is a marketing technique that recognises and rewards customers who purchase from a company on a regular basis.

**Define** is an AO1 level command term, requiring the precise meaning of a term.

- One mark is given for a vague definition.
- Two marks are given for a complete definition.
- Definitions do not require application to the stimulus material.

**Question 2**

One benefit of a customer loyalty programme is customer engagement. A customer loyalty programme encourages repeat business and helps with customer retention. In the context of Checkers Sixty60, a customer loyalty programme allows customers to benefit from discounts if they engage with the brand, use the app and make regular purchases. Therefore, the loyalty programme encourages loyalty and repeat business, which improves Checkers Sixty60's revenues.

In addition, customer loyalty programmes allow businesses to build up a database of customer shopping habits and purchases. This data can be mined and analysed for patterns and trends that can inform marketing decisions. In this case, Checkers Sixty60 can gather data from its customers, which it can use to target customers with personalised promotions. This increases the likelihood of shoppers continuing to purchase via Checkers Sixty60. Checkers Sixty60 is able to build a relationship and incentivise customers to purchase more of their favourite items.

**Analyse** is an AO2 level command term, meaning to break down in order to bring out the essential elements or structure.

- Two benefits need to be addressed. Other responses are possible and would be rewarded if appropriate.
- To access full marks, you must always include theory and application to the case study in your responses to the analyse command term.

Student view

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# 3 section questions

Question 1 Student... (0/0) Feedback Print (/study/app/business-hl/sid-351-cid-762729/book/internet-of-things-ai-big-data-id-39511/print/) Assign

A customer 1 Loyalty progr... ✓ is a marketing technique that recognises customer engagement and rewards consumers for regular repeat purchases.

**Accepted answers and explanation**

#1 Loyalty programme
Loyalty program

**General explanation**

A customer loyalty programme rewards brand loyalty. It encourages consumers to make repeat purchases in order to receive rewards. The system is also used to monitor customers' habits and purchasing patterns. This data can then be used to target consumers with promotions.

**Question 2**

What type of promotional strategy is a customer loyalty programme?

1 Below the line ✓

2 Between the line

3 Above the line

4 Around the line

## Explanation

A below the line marketing strategy is a marketing strategy whereby products are promoted via media that is not either TV or radio. It is a more directed form of marketing strategy. Customer loyalty programmes allow a business to gather data on consumers, this data can be used to develop marketing promotions such as targeted emails, discounts or promotions which are personalised to the individual consumer based on prior purchases.

Student view

**Question 3**

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Which of the following is an ethical concern related to customer loyalty schemes?

1 Customer profiling ✓

2 Failure to meet customer needs

3 Failure to comply with advertising standards

4 Failure to comply with terms and conditions

**Explanation**

Customer profiling is a part of a business strategy that allows a business to segment consumers into different categories. It is not illegal but there may be ethical concerns related to it. For example, if a business uses data from a customer loyalty programme to profile customers, targeting them with promotions for products that could influence negative behaviours such as excessive consumption of unhealthy foods, or to deny certain customers services.

5. Operations management / 5.9 Management and information systems (HL)

# Digital Taylorism

The use of employee data (HL) Advanced computer technologies (HL)

Frederick Taylor, the 20th century guru of scientific management, focused on the drive for standardisation of tasks and the rigorous pursuit of staff efficiency. His theory of motivation is discussed in unit Subtopic 2.4 (/study/app/business-hl/sid-351-cid-762729/book/the-big-picture-id-39054/). The concept was thus: break complex tasks into simple ones, link pay and performance, and monitor everything your workers do. Taylorism has been updated for the digital age. Welcome to _(undefined)digital Taylorism, a 21st century version of his theories, which makes use of surveillance technology to monitor worker output.

Student view

**Figure 1.** Taylorism from the past: worker timecards.

Credit: Monty Rakusen, Getty Images

In the modern gig economy (undefined)gig economy (undefined)gig economy, ride hailing apps and food delivery apps use computerised systems to manage and monitor workers. Managers and owners can analyse worker behaviour in detail, using data to analyse every aspect of performance, such as delivery times. In the logistics and shipping industry, digital Taylorism allows management to use sensors to track performance by tracking locations, timing, driving, delivery success, delivery rates and many other metrics. This may be used to administer piece-rate (undefined)piece-rate (undefined)piece-rate pay and may act as a monetary incentive to workers, ensuring that they meet targets in order to receive pay or bonuses. In other words, it could be used as an extrinsic motivation (undefined)extrinsic motivation (undefined)extrinsic motivation tool.

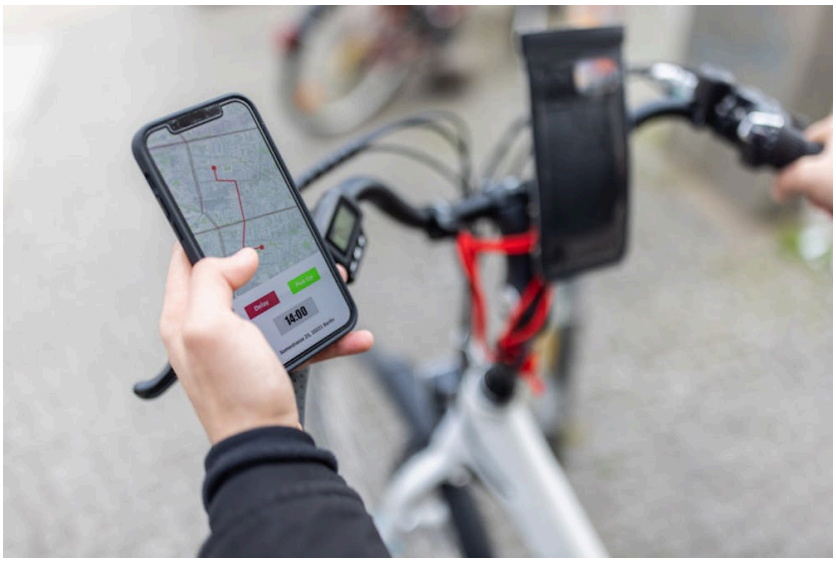

**Figure 2.** Delivery workers are monitored with apps that track performance.

Credit: Luis Alvarez, Getty Images

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Algorithms and analytical software systems allow management to acquire data that can be used to instruct employees or conduct appraisals. The data from tracking tools provides information that allows managers to evaluate whether to keep employees, provide additional training or discipline or remove employees who consistently fail to hit targets.

Digital Taylorism is sometimes used without employees' direct knowledge. Programmes on office computers or on cash register apps can monitor keystrokes, record audio and assess time spent on certain programmes in order to check employees' productivity. And as remote working has become more common, workplace surveillance has increased (https://www.theguardian.com/technology/2022/apr/27/remote-work-software-home-surveillance-computer-monitoring-pandemic).

### International Mindedness

Privacy laws, which include the use of data on employees, differ around the world (https://www.dlapiperintelligence.com/goingglobal/employment/index.html?t=11-data-privacy). In most countries, however, employers have a legal right to monitor employees, as long as there is a legitimate business interest to do so.

## Evaluation of digital Taylorism

Monitoring employees using digital technologies has its benefits for efficiency. But businesses must be careful not to create a culture in which employees feel as if they are constantly being watched. Whilst this type of monitoring may work for some businesses, it can lead to problems for others, particularly with respect to motivation. **Table 1** outlines some of the major advantages and disadvantages of digital Taylorism.

**Table 1.** Advantages and disadvantages of digital Taylorism.

| Advantages of digital Taylorism | Disadvantages of digital Taylorism |
|---|---|
| **Increased efficiency.** Workers are monitored and incentivised to increase productivity in order to meet targets; workers can increase their pay when they perform efficiently and well. | **Lower motivation.** Digital Taylorism reduces employee autonomy, which can reduce motivation and increase labour turnover. |
| **Improved appraisal.** Management can assess worker performance and productivity using data analytics rather than using less scientific measurements. | **Reduced creativity.** Digital Taylorism may reduce the scope for workers to find creative solutions to problems, as they fear missing targets. |

Student view

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| Advantages of digital Taylorism | Disadvantages of digital Taylorism |
| --- | --- |
| **Improved decision-making.** Businesses can use data to make informed human resource decisions on employment. | **Dehumanisation and overwork.** Data could be used in a dehumanising manner, turning workers into robots that complete task after task. |

## Case study

Deliveroo connects restaurants with customers to deliver food; it uses thousands of delivery personnel in the gig economy. Deliveroo delivery drivers work on demand, accepting orders from the app. The app provides the driver with GPS information to the restaurant from where they collect the food, and then provides them with GPS information to the customer to which they deliver the food. The algorithm used in the Deliveroo app acts as the boss, tracking the performance of the delivery personnel.

Deliveroo uses algorithms to monitor delivery personnel. Delivery drivers receive orders for food via the app. The app then monitors the average time taken to accept orders, ride to the restaurants, the travel time to the customer, the time with the customer, late orders and orders that were not assigned. The algorithm measures a delivery worker against average standards. Drivers receive information that informs them whether they were above or below the average.

Deliveroo has moved to a piece-rate system of pay.  The company has shifted the risk of deliveries on to the workers. The piece-rate system means that workers can measure the relationship between their performance and pay. Their pay is influenced by the number of deliveries that they make.

Deliveroo states that the piece-rate system is necessary to manage personnel in the absence of management and that such a system is efficient. However, labour activists have criticised the dehumanising nature of being managed by algorithms and the impact it can have on the treatment of workers as machines. It has been referred to as digital Taylorism.

Questions

1. Define the term Digital Taylorism. [2 marks]
2. Explain **one** way in which the use of algorithms benefits Deliveroo. [2 marks]
3. Explain **one** advantage and **one** disadvantage of digital Taylorism for Deliveroo's drivers. [4 marks]

### Question 1

Digital Taylorism is a modern version of Taylor’s scientific management that uses digital technologies to monitor every aspect of employee performance. Performance can be linked to piece-rate pay to increase efficiency.

**Define** is an AO1 level command term, requiring the precise meaning of a term.

Student view

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- One mark is given for a vague definition.
- Two marks are given for a complete definition.
- Definitions do not require application to the stimulus material.

### Question 2

With digital Taylorism, data is collected, and algorithms are used to monitor and assess workforce performance to improve efficiency. This benefits Deliveroo because the data collected provides details on worker performance at a relatively lower cost, since management is not needed. Delivery driver data is then compared to an average in order to assess whether workers are completing deliveries on time, providing details on the number of deliveries completed. This is then used to allocate piece-rate pay relative to performance.

**Explain** is an AO2 level command term, requiring a detailed account including reasons or causes. Explain *why*, explain *how*.

- Only one benefit needs to be explained. Other responses are possible and would be rewarded if appropriate.
- To achieve full marks, you must always include theory and application to the case study in your responses to the **explain** command term.

### Question 3

The data collected on workers makes their performance transparent to them and to the employer. There is a direct link between performance and pay that may incentivise the workers to improve their performance. In this case, Deliveroo drivers can constantly assess their own performance and make changes to their deliveries in order to improve efficiency and earn higher pay. Therefore, the application provides an extrinsic motivation to encourage staff to be more productive.

Digital Taylorism can be demotivating to workers. The algorithms can set difficult targets, and pushing workers to meet those targets could cause stress and a demanding workload.  Deliveroo workers may feel that they are being dehumanised; that they are being treated as ‘numbers’. Some may feel a lack of job security as they may be unable to continue working if they do not hit their targets, even if the circumstances are out of their control.

**Explain** is an AO2 level command term, requiring a detailed account including reasons or causes. Explain *why*, explain *how*.

- Only one advantage and one disadvantage need to be explained. Other responses are possible and would be rewarded if appropriate.
- To achieve full marks, you must always include theory and application to the case study in your responses to the explain command term.

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## 3 section questions

**Question 1**

1 Digital Taylori... ✓ is a modern version of Taylor's scientific management that uses digital technologies to monitor every aspect of employee performance.

**Accepted answers and explanation**

#1 Digital Taylorism

**General explanation**

Digital Taylorism is a modern approach to scientific management. It utilises technology as a tool to monitor and incentivise workers to increase productivity.

**Question 2**

What is a piece-rate system?

1 A worker is paid per unit of output produced. ✓

2 A worker receives a bonus for sales.

3 A worker is paid a fee regardless of output.

4 A worker is paid per annum for their service.

**Explanation**

A piece-rate system is an extrinsic motivation tool. Workers receive pay according to how many units of output they produce.

**Question 3**

Which of the following is **not** a benefit of digital Taylorism?

1 It can stimulate creativity. ✓

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2 It can be used to monitor staff output.

3 It can help to boost worker efficiency.

4 It ensures targets are met by linking pay to performance.

Section Student... (0/0) Feedback Print (/study/app/business-hl/sid-351-cid-762729/book/digital-taylorism-id-39513/print/) Assign

### Explanation

Digital Taylorism is an updated version of the scientific management created by Taylor. The system is focused on using technology to manage worker output. Targets are set and workers strive to achieve those targets in order to receive certain piece-rate payments. Digital technologies monitor and check performance against metrics to ensure workers are efficient. The system is based on the breakdown of tasks into simplified processes. There is no room for creativity, it is solely based on results and output.

5. Operations management / 5.9 Management and information systems (HL)

# Terminology exercise

Section Student... (0/0) Feedback Print (/study/app/business-hl/sid-351-cid-762729/book/terminology-exercise-id-39514/print/) Assign

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**Check that you understand the terminology used in this subtopic by dragging the correct word into each space.**

A information system is any system that is used for decision-making or for organising information. It involves information being collected in a structured, organised computer system known as a . The data is then interpreted using a scientific process known as . Many of these processes are automated.

The use of digital systems requires critical . Large buildings – known as – containing computers, servers and other hardware are needed to operate digital technologies. Many of these make use of intelligence, where a computer, robot or other machine is controlled by a computer. This enables tasks that would normally be carried out by humans to be automated. These digital systems are becoming more and more sophisticated and, through machine learning, are able to complete more and more processes.

Through the use of interconnecting nodes known as artificial , which replicate the human brain, businesses are able to apply machine learning or deep learning technologies. These make effective use of algorithms that can automate processes or help management to make effective decisions.

infrastructure | database | management | neural networks | data analysis | artificial | data centres

Check

Question: 1 of 2 questions

**Interactive 1.** Understanding Management and Information Systems.

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# Checklist

Section | Student... (0/0) | Feedback | Print (/study/app/business-hl/sid-351-cid-762729/book/checklist-id-39515/print/) | Assign

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## What you should know

By the end of this subtopic, you should be able to:

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- define the following terms: (AO1)
  - management information systems
  - data analytics
  - databases
  - data mining
  - cybersecurity
  - cybercrime
  - artificial neural networks
  - data centres
  - cloud computing
  - virtual reality
  - internet of things (IoT)
  - artificial intelligence (AI)
  - big data
  - customer loyalty programmes
  - digital Taylorism
- describe data analytics, databases, cybersecurity and cybercrime (AO1)
- analyse the importance of critical infrastructures, including artificial neural networks, data centres and cloud computing (AO2)
- explain the role of virtual reality (VR) in business (AO2)
- comment on the importance of the internet of things, artificial intelligence and big data (AO2)
- examine the benefits and drawbacks of customer loyalty programmes (AO3)
- discuss the use of data to manage and monitor employees; digital Taylorism (AO3)
- evaluate the use of data mining to inform decision-making (AO3)
- examine the benefits, risks and ethical implications of advanced computer technologies (management information systems) and technological innovation on business decision-making and stakeholders (AO3)

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# Reflection

Student view

## Teacher instructions

The goal of this section is to encourage students to pause at the end of the subtopic and to reflect on their learning. Students can use the questions provided below to guide their reflection. The questions encourage students to look at the bigger picture and to consider how the subtopic's contents might have impacted the way they view the subject.

The following table shows you how each prompt aligns to the DP *Business management guide*:

| Prompt # | Syllabus alignment |
|---|---|
| 1 | **Concept:** Ethics |
| 2 | **Learner profile:** Caring |
| 3 | **Concept:** Ethics |
| 4 | **Learner profile:** Balanced |

Students can submit their reflections to you by clicking on 'Submit'. You will then see their answers in the 'Insights' part of the Kognity platform.

## Reflection

In this subtopic you learned about management and information systems.

Take a moment to reflect on your learning so far. You can use the following questions to guide your reflection. If you click 'Submit', your answers will be shared with your teacher.

1. To what extent is it acceptable that the firms that collect data may know more about you and your family than you want to disclose?
2. How can we as a society best protect the data of those who are vulnerable (for example, the elderly and those with intellectual disabilities)?

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3. Should we use facial recognition technology or track eye movements to assess student engagement in class or prevent cheating in exams?
4. In Subtopic 5.3 (/study/app/business-hl/sid-351-cid-762729/book/the-big-picture-id-39339/) you learned about how firms aim to minimise costs. To what extent does the often costly storage management of large amounts of digital data conflict with efficiency in production? Do businesses have a responsibility to pay for the highest level of data protection?

⚠ Once you submit your response, you won't be able to edit it.

0/2000

Submit

## Rate subtopic 5.9 Management and information systems (HL)

Help us improve the content and user experience.

☆ ☆ ☆ ☆ ☆

Student view