HL IB Business Management

5.9 Management Information Systems
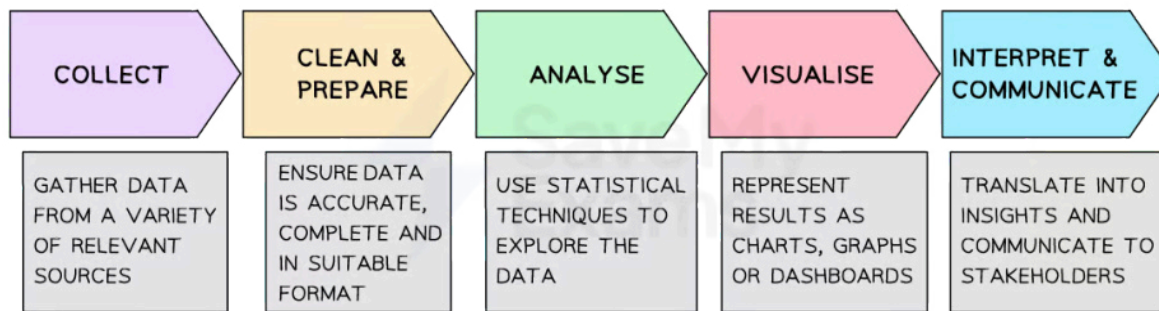
Your notes

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Information System Terminology

Key Information System Terminology

Data Analytics

- Data analytics involves **transforming raw data into useful information** to uncover **patterns, correlations, trends** and **insights**

- Data analytics has become **increasingly important** to businesses in today's data-driven world
  - It helps organisations to gain a **competitive advantage** and make **informed decisions**
  - **Data-driven** decision making tends to be less risky than pursuing hunches

Diagram Illustrating Key Components of Data Analytics

COLLECT	CLEAN & PREPARE	ANALYSE	VISUALISE	INTERPRET & COMMUNICATE
GATHER DATA FROM A VARIETY OF RELEVANT SOURCES	ENSURE DATA IS ACCURATE, COMPLETE AND IN SUITABLE FORMAT	USE STATISTICAL TECHNIQUES TO EXPLORE THE DATA	REPRESENT RESULTS AS CHARTS, GRAPHS OR DASHBOARDS	TRANSLATE INTO INSIGHTS AND COMMUNICATE TO STAKEHOLDERS

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Data Analytics involves the collection, cleaning & preparation, analysis, visualisation and interpretation of data before communicating to stakeholders

Types of Data Analytics

Descriptive	Diagnostic
- Analysis focuses on **past business performance** - Summarise sales data over a given period - Identify periods of high and low spending/costs - Show periods of success and failure	- Analysis focuses on **reasons for past performance** - Make links between promotional spending and sales - Correlate employee performance with quality - Examine the impact of capital spending on output
Predictive	**Prescriptive**
- Analysis focuses on **likely future performance** - Make sales forecasts	Analysis leads to **recommendations for actions/decisions**

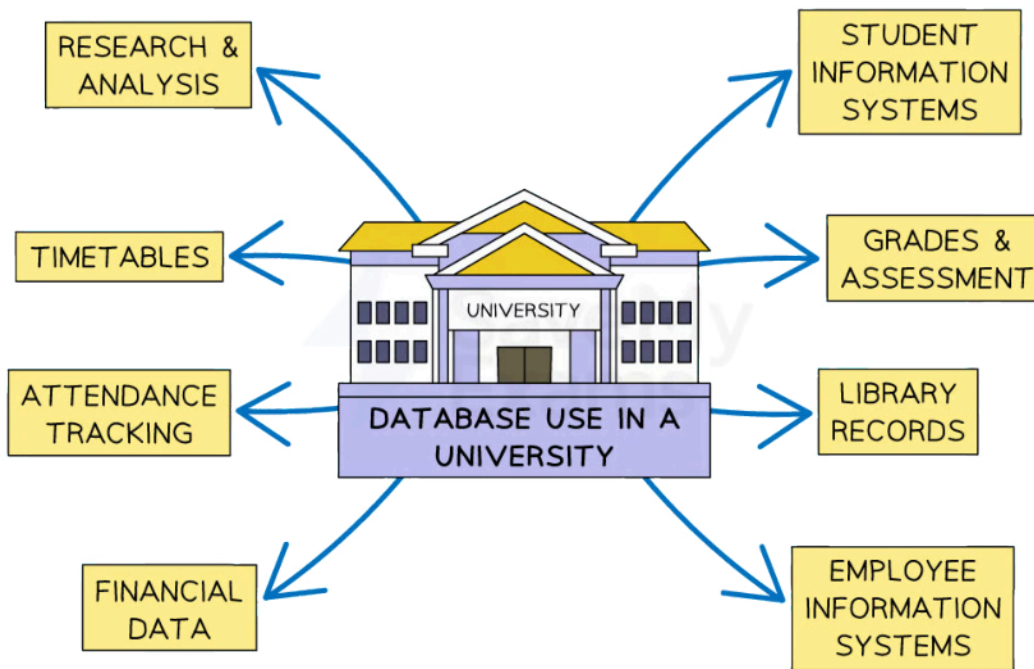| • Predict changes in costs | • Changes in marketing strategy |
| • Determine future staffing needs | • Implement recruitment drives |
| | • Enter new markets |

Databases

- A database provides a **structure for stored data**
- Typically electronic databases allow for swift **data input, storage, protection and retrieval** of information
- Setting up and maintaining databases can be costly
  - Data must be **kept secure**
  - **Database managers may be required** to ensure databases are fit for purpose

Diagram: Database Use in a University

Universities use database systems for many reasons, including student and employee information systems, library management and attendance tracking

Cybersecurity & Cybercrime

- Cybersecurity includes systems used to **protect computer networks** from **theft or unauthorised access** of data

- Cybercrime is **illegal activity** related to the use of computer or network devices

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- It is often related to **financial or commercial gain**
- It is a **significant risk** to business - according the UK government **cybercrime cost British businesses** an average of £1,100, with 69% of large businesses reporting a significant cyber-attack in 2022

Common Forms of Cybercrime

Form	Description
Phishing	- Tricking individuals or businesses into providing **sensitive information** such as passwords or credit card numbers by posing as a trustworthy organisation in electronic communications
Ransomware/Malware attacks	- Malicious software includes **viruses, worms, Trojans and spyware** designed to **disrupt, damage or gain unauthorised access** to computer systems - Ransomware is a type of malware that encrypts users' files and demands a fee to be paid for their release
Identity theft	- Stealing personal information such as social security numbers or credit card details to commit fraud or other related crimes
Email/internet fraud	- Schemes distributed via online communications designed to deceive individuals for financial gain such as online shopping scams or investment fraud
Intellectual property theft	- Theft, unauthorised use or piracy of others' creations, trademarks or copyrighted material
Account hijacks	- Distributed Denial of Service (DDoS) attacks involve overwhelming a website or online service with traffic, causing it to become slow or unavailable

- A business can **protect itself** against cybercrime in a number of ways

Ways to Protect Business Systems from Cybercrime

Method	Explanation
Employee training and awareness	- **Train** employees on cybersecurity best practices - Raise **awareness** about phishing attacks - Encourage a **culture of security** consciousness within the business
	- Conduct regular **cybersecurity audits** to identify vulnerabilities

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Regular security audits & access control	▪ **Test** the effectiveness of security measures ▪ **Stay informed** about the latest cybersecurity threats ▪ Grant only **necessary access rights** to groups of users ▪ Regularly review **user access** - especially when staff leave the business
Strong password & encryption policies	▪ Enforce **complex password** requirements ▪ Implement **multi-factor authentication** (MFA) for added security ▪ **Encrypt sensitive data** both in transit and when stored
Backup and recovery	▪ Regularly **back up** critical data and systems ▪ Test **data restoration procedures** to ensure quick recovery in case of an attack ▪ Develop an **incident response plan** including clearly-defined roles and responsibilities in case of a security incident

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💡 Examiner Tip

Despite taking all possible steps to protect their IT systems, businesses that increasingly rely on technology to manage key business processes are at risk from cybercrime

Business continuity following disruptions to IT systems is an important part of contingency planning and must be updated regularly to be effective against the latest risks

Critical Infrastructures

- Critical infrastructures are **IT-based systems and facilities that are central** to the effective operation of a business
- Examples of critical infrastructures include
  - Artificial neural networks
  - Data centres
  - Cloud computing

- **Artificial neural networks** (ANNs) are **computer systems inspired by the way the human brain works**
  - They **automate business tasks** in some well-known businesses
    - **Chatbots** are used by businesses such as **Next Retail** to respond to customer service queries
    - Insurance companies such as **Admiral** use ANN's to **detect fraud** in insurance claims where unusual patterns need to be identified
    - Manufacturers including **Toyota** and **Hyundai** use ANN's to **monitor machinery** and predict when equipment is likely to fail so timely maintenance tasks can be carried out
    - Large retailers such as **Tesco** use ANNs to monitor temperatures in stores' refrigerated units to ensure that perishable goods are stored safely

- **Data centres** are physical spaces that hold **important applications** and **data** on behalf of a business
  - Their components include **mainframes, servers, routers, firewalls** and **storage systems**
  - Services such as data backup, security, database management and storage, email and file sharing and virtual communications systems are provided by data centres

- **Cloud computing** is similar to a data centre though applications and data are stored **online rather than in a physical location**
  - Examples include **Google Drive, Dropbox** and **Apple's iCloud**
  - Remote servers and online networks are used to store and share data

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Virtual Reality, the Internet & Artificial Intelligence

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Virtual Reality

- Virtual reality (VR) allows users to **explore and interact** with a **realistic 3-dimensional (3D) environment** created using software
  - VR can be used in a number of ways by businesses

Business use of Virtual Reality

Use	Explanation	Examples
Education and training	**Simulations:** VR is used for training allowing practice in realistic scenarios without real-world consequences **Virtual Classrooms:** VR enables students to explore subjects in an engaging way	**United Airlines** uses VR applications to train pilots and ground staff in safety and emergency procedures **EdApp's Virtual Classroom** can be used to deliver short-form interactive content on any compatible electronic device
Retail	**Virtual Shopping:** Retailers use VR to create virtual stores that allow customers to shop from the comfort of their homes **Product Prototyping:** VR is used to visualise designs and develop 3-D prototype products at low cost	**IKEA** uses VR to create a virtual showroom where customers can visualise purchases by customising room layouts, materials and colours **Jaguar Land Rover** uses VR to create full-size 3D models of components and entire vehicle before the physical parts are built
Entertainment	**Gaming:** VR is widely used in the gaming industry to provide immersive gaming experiences with the use of VR headsets **Virtual Theme Parks:** Amusement parks and entertainment venues use VR in rides	**Beat Games'** *Beat Saber* is a rhythm game where players wear a VR headset and move their limbs around glowing sabers to the beat of a musical track Amusement park **Alton Towers** uses VR to enhance customer experience on its *Galactica* rollercoaster

- In addition, virtual reality can help businesses to **deliver realistic training** and has been used by some large businesses to develop **immersive advertising**

The Internet of Things

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- The Internet of Things (IoT) refers to the **connection of everyday objects to the internet** which allows them to send and receive data for various purposes
  - In an IoT system **tasks are performed with little or no human intervention**
  - Devices can range from simple **household items such as refrigerators** and **smart speakers** to complex industrial machinery

- Businesses such as **Amazon** have enjoyed commercial success with devices such as the *Echo* and its *Alexa* software

- Devices can also be used within businesses to improve the efficiency of processes
  - **Volvo** car dealerships use data from **embedded sensors in vehicles** to offer timely maintenance to owners and ensure appropriate parts are in stock
  - Smart **climate control systems** are used in **Sainsbury**'s supermarket distribution hubs to ensure perishable goods are not wasted

Artificial Intelligence

- Artificial intelligence (AI) allows machines to complete **tasks that normally require human intelligence or reactions**
- Although **in its infancy**, some businesses are enjoying considerable commercial success in the field

Examples of Top AI Businesses in 2023

Google (Alphabet Inc)	Amazon Web Services
- Major player in AI with applications in search, language processing and image recognition	- Uses AI extensively in e-commerce operations and Alexa, its virtual assistant, is powered by AI
Tesla	**OpenAI**
- Leading in incorporating AI into the automotive industry, particularly in the development of self-driving technology	- Known for its research and development into AI with a stated aim of ensuring that the technology benefits all of humanity

- AI can **carry out numerous business functions** and improve their efficiency
  - In **Human Resources** AI filters job applications and compiles shortlists for interview
  - **Logistics** have been improved by the use of AI-powered tools such as Google Maps which gather and process real time travel conditions
  - AI manages some **customer service** functions, powering chatbots and improving the efficiency of search engines
  - Automatic payment systems such as Paypal incorporate AI to improve **financial management**

Your notes

> 💡 **Examiner Tip**
>
> At the time of writing governments around the world are considering taking steps to monitor and control the use and capabilities of AI
>
> It is worthwhile keeping up with steps they take to protect individuals over the next few years – showing a contemporary understanding can improve the quality of your analysis and judgements

Data Management

Big Data

- Big data refers to large volumes of data that inundate businesses on a day-to-day basis
- Businesses have **more opportunities than ever before** to gather vast amounts of data
- Big data can be used to **understand customers** better, **make informed strategic decisions** and **offer more personalised services** that meet customer needs

New Ways Businesses Collect Big Data

E-commerce	Social media
Collection of data related to online purchases, search variables and purchase preferences	Interactions on platforms such as *Facebook* and *Instagram* can be analysed to identify trends, complaints and product popularity
Internet of Things (IoT)	**Logistics**
Data is gathered automatically from devices including smartphones, apps and smart appliances	Data gathered from location tracking tools can improve transportation and delivery processes

Customer Loyalty Programmes

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- Customer loyalty programmes are a way to **gather large amounts of data on spending habits and behaviour of customers**
  - **Financial and transactional data** includes information about payment methods and details of products purchased
  - **Interaction data** relates to how customers engage with surveys, feedback on in-store and online shopping experiences and CCTV data such as queue monitoring or number plate recognition
  - **Marketing data** includes customer interaction with online marketing such as the opening of marketing emails and interaction with adverts while browsing the internet

- In return for allowing access to this amount of data loyalty schemes often offer **discounts** or **reward points** that can be very attractive to customers
  - Customers feel **connected** to a business that rewards them and are **more likely to remain loyal** over time
  - Loyal customers frequently **recommend** the business to others and provide **meaningful feedback**
  - **Promotional costs may be reduced** as there is less of an urgent need to attract new customers

- Loyalty schemes help a business to differentiate itself from rivals and allow for **greater personalisation of promotional activity**

- Loyalty programs have several **drawbacks**
  - Operating loyalty schemes can be **expensive** - especially for businesses with limited resources
  - Customers may come to **expect discounts** which could devalue a businesses products
  - Customers may be disinterested by **too many loyalty programs**
  - Storing customer data for loyalty programs raises **concerns about privacy and data security**

> ## 💡 Examiner Tip
>
> Not all loyalty schemes are powered by technology
>
> Businesses may reward customers with stamps each time they spend money with them, rewarding their loyalty with free or discounted products
>
> However they are unable to access the volume of data possible with IT-based systems and, therefore, these forms of loyalty card should only be considered as a marketing tactic

Digital Taylorism

- Digital Taylorism involves **using technology to carefully monitor** workers' use of the **tools and techniques** for completing their work tasks
  - In 2022, 80% of large US corporations in the United States had their employees under regular surveillance
  - Examples include **Amazon**, **FedEx** and **Deliveroo**

- **Pay** and other financial rewards are **linked to achieving performance targets**
  - In some cases workers may receive sanctions based on data collected automatically
    - In 2020 *Amazon* workers complained of facing disciplinary action for taking toilet breaks during their shifts

- **Technological innovations** have made it much easier for managers to quickly and cheaply collect, process, evaluate and act upon vast amounts of employee performance information
  - In **logistics** computer systems **control vehicle fleets** and employees
    - **Sensors** track location, timing, driving and other aspects of performance
    - Complex algorithms and analytics software instruct truck drivers which routes to take as well as expected schedules
  - In **retail** employee performance data can be gathered from programs running in the background of the **computerised cash register**
    - Keystrokes can be logged, audio/video can be recorded and time taken to serve customers can be continuously collected

Benefits of Using data to Monitor Employee Performance

Benefit	Explanation
Coordination & control	- Data can ensure that the right number of employees are available when needed - Poor performance can be identified quickly and acted upon by managers
Training & staff development	- Data can identify skills gaps and training needs for employees - Data such as recorded customer interactions can be used as real-life training workshop materials

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Employee engagement & rewards	• Regular data-based feedback improves communication between managers and employees • Data can identify high-performing employees for rewards, boosting morale
Less management time required	• Systems that automatically collect data can reduce the amount of time managers need to directly oversee the work of subordinates

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💡 Examiner Tip

Consider how you would feel if your work were closely monitored through the use of technology

This is an excellent topic to include your own opinions and experiences - both positive and negative
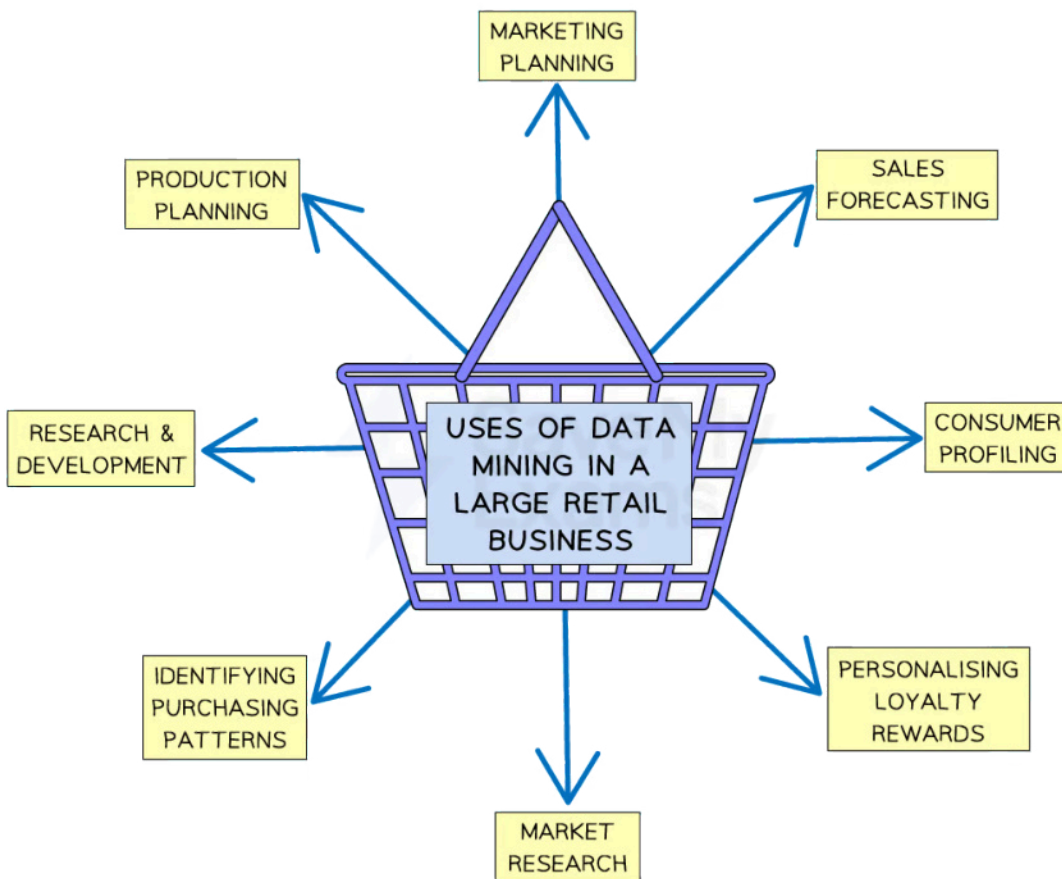
Using Data to make Decisions

Data Mining

- **Data mining** occurs when raw data is extracted from large data sets and converted into useful information
- This information is used to make **data-driven decisions** that reduce risk and help a business to increase revenue, reduce costs and improve customer relations

Diagram with the Common Uses of Data Mining

Data Mining can be used by a large retail business to plan marketing and production, identify purchasing patterns and profile customers

- **Marketing Planning**
  - Identify successful marketing strategies
  - Determine market segments

- **Sales Forecasting**

- Identify sales trends
- Set revenue budgets based on past performance

- **Consumer Profiling**
  - Connect purchasing habits with demographic data
  - Target promotions that appeal to specific groups of customers

- **Personalising loyalty rewards**
  - Compare success of previous loyalty rewards
  - Target rewards that appeal to specific groups of customers

- **Market research**
  - Predict future customer preferences based on past consumption

- **Identifying purchasing patterns**
  - Compare products bought at particular locations, times and combinations with other goods
  - Tailor product availability

- **Research & Development**
  - Allocate future spending on R&D based on extrapolation of past trends

- **Production Planning**
  - Identify supply chain disruptions
  - Prioritise availability of products based on past demand

Criticisms of Data Mining

Criticism	Explanation
Invasion of privacy	Large-scale collection and analysis of personal data can **make individuals feel uncomfortable** or violated when this information is used without their explicit consent
Data breaches	Storing large amounts of data increases the risk of security breaches where **sensitive information such as banking or health details may be made public**
Discrimination	Decision-making based on mined data may unintentionally discriminate against certain groups which could **worsen social and economic disparities** between, for example, men and women

Your notes

Evaluating the Impact of Technology on Decision Making and Stakeholders

- Technology has had a significant impact on business decision-making and stakeholders in recent years
  - Technology provides **tools for data analysis** which improves efficiency and communication
  - **Innovation** is driven by technological advances and provides a competitive advantage
  - Employees may benefit from these advancements through **improved workplace experiences**

Positive Impacts of Technology on Business Decision Making and Stakeholders

Impact	Explanation

Data-driven decision making	- Vast amounts of data can be collected, processed and analysed
	  - This allows businesses to make **informed decisions** based on real-time insights and trends
	  - This leads to improved business performance and increased financial rewards

Efficiency & productivity	- Automation and technology tools enhance operational efficiency and productivity
	  - This improves decision-making by **streamlining processes** and **reducing human error**
	  - Customers experience improved services and faster delivery times

Communication & collaboration	- The use of video conferencing, collaboration software and messaging apps can speed up decision making
Customer experience	- Automated tools such as chatbots and personalised marketing tactics made possible through data mining improve customer interactions - Monitoring customer experiences means training can be tailored for employees
Innovation & adaptability	- Technology provides **tools for research and development** - Businesses can adapt to changing market conditions quickly as trends can be identified in real-time

Supply chain management	- Technologies such as the **Internet of Things** have transformed supply chain management - Businesses can track goods in real-time which improves the more efficiency of supply chains

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Legal, ethical and practical concerns

Data Security & Privacy	Ethical Use of Data	Employee Training & Adaptation
- **Data breaches** can lead to unauthorised access to sensitive information which could result in financial and reputational damage - Business must follow strict data protection **regulations** such as GDPR and CCPA	- Algorithms and AI-based systems can inherit biases which can lead to discrimination - **Lack of transparency** in how businesses use customer data can damage trust	- Rapid technological advancements may result in **skill gaps** among employees who may need training to keep up with the latest tools - **Resistance to Change** amongst employees may affect the introduction of digital processes
Data Quality and Accuracy	**Dependency & Reliability**	**Environmental Impact**
- **Garbage In, Garbage Out (GIGO)** means that inaccurate or low-quality data can lead to poor decisions - Ensuring data is **accurate** and **reliable** is crucial for making informed business decisions	- **System failures** or **technical glitches** can disrupt business operations - Businesses that use **third-party services** and platforms may struggle if critical services are no longer available	- The growing use of technology – especially data centres – **increases energy consumption** which raises concerns about environmental sustainability - **Disposal of equipment** is environmentally problematic – especially in poorer countries