

## DATA, INFORMATION AND KNOWLEDGE

Computers are machines that process **data**. Information systems perform processes on this data and output it as **information**. Individuals with knowledge of the wider context can then **use** this information to draw conclusions and make decisions. But what is the difference between data, information and knowledge?

<b>Data</b>	Raw facts and figures – on their own they have no meaning
<b>Information</b>	Data with context which makes it meaningful
<b>Knowledge</b>	Using information to make decisions

### Example

Data:	105, 45, 89, 69								
Information:	Here is a price list of Nike Trainers:								
	<table border="1"> <tr> <td>Air Max Tailwind</td> <td>£105</td> </tr> <tr> <td>Jet Stream</td> <td>£45</td> </tr> <tr> <td>Air Max 90</td> <td>£89</td> </tr> <tr> <td>Air Classic</td> <td>£69</td> </tr> </table>	Air Max Tailwind	£105	Jet Stream	£45	Air Max 90	£89	Air Classic	£69
Air Max Tailwind	£105								
Jet Stream	£45								
Air Max 90	£89								
Air Classic	£69								
Knowledge:	I only have £50 to spend and can therefore only afford the Jet Stream trainers for £45								



Getting from Data to Knowledge:



Data has potential meaning because it represents events, amounts, individuals, dates etc

This adds context to the data, a specific use to which it will be put. This information will need to be processed into a form that is easy to understand

People with knowledge of the context of the information will be able to draw conclusions, make decisions, identify problems etc

**Example**

This data is stored on computer	140/80
This is the information that is displayed	Blood Pressure is 140/80
You may not be able to apply knowledge to this information because you know very little about blood pressure, but a member of the medical profession could apply his/her knowledge to this information and decide if a patient is at risk or not.	

**ENCODING DATA**

If large amounts of data are being processed, data items are often replaced by codes eg the items in a supermarket have bar codes on them representing the product number. This code is used to enter data into the computer. If details need to be printed out then more meaningful information will be given.

**Example**

At the supermarket checkout, the bar code is scanned to enter data in the form of a product number, but when the receipt is printed out the name of the product is displayed.

**Western Mail bar code**

**Till receipt**



DUR BATT ALK AAAX4	3.85
WESTERN MAIL	0.50
DAILY POST	0.40
GUARDIAN SATURDAY	1.10

**Encoding data means converting information or data into a code for processing. Decoding data means converting it back into a form that can be understood.**

Here are examples of common codes:

Male and Female	M and F
International Standard Book Number (ISBN)	0-340-80007-0
Bank sort codes	20-18-41
Date of Birth	20 06 86
Rating score	1-5 for effort on a pupil's report

Codes are used because:

- they are often short and easy to enter
- they take up less storage space on disk
- they are easier to validate

### Problems

The main problem with encoding data is that you lose accuracy because it sometimes restricts choice. Often the information needs to be entered as data into a database and databases require data sorted in an organised and set format. The database designer must think about the structure used to store data and must be careful not to lose detail which may be important to the user.

### Example

A modelling agency holds details of the models on its books on a database. The database designer classed hair colour as either blonde, brown, black or red. This will cause problems if you need to differentiate between light brown, dark brown and reddish brown. Once the data is entered, this is all there is to work on so any finer distinctions will be lost.

### Value Judgement

A value judgement is a matter of opinion rather than fact. The problem with a value-judgement is that there isn't a single correct value. The value depends on opinion and may differ from someone else's opinion.

I start work at **7 am** each day – this is fact.

I start work **early** each day – this depends on someone’s classification of **early**.

Bakers at the famous Betty’s tea shop in Harrogate start work at 2 am so wouldn’t consider a 7 am start all that early! Pupils who start school at 9 am would consider 7 am early.

Here are other categories of responses that contain value judgement:

- young, middle-aged, old
- tall, average, short
- often, not very often, never

The following values are to be entered into a computer system. For each one, state whether the data is fact or a value judgement:

- 1 a person’s state of health (healthy, fairly healthy, unhealthy)
- 2 the weight in pounds of a person
- 3 a person’s build (small, medium or large)
- 4 the current minimum wage is £4.60
- 5 how much a person eats (small, medium or large portion)
- 6 the number of days a pupil has been off school this year
- 7 how much TV you watch each night (a little, average, a lot)
- 8 a person’s date of birth

### THE VALUE AND IMPORTANCE OF INFORMATION

Good information is up-to-date, accurate, and complete. It can add value to organisations and companies. For this reason it is seen as a commodity and is often bought and sold. Good information helps organisations and companies in the following ways:

Help decision-making	Decision-making is based on information that is available at the time and if this is either out-of-date or incomplete then this can have a bad effect on the organisation or company. Good quality information that leads to effective decision-making can make an organisation or company more successful.
Use resources	Organisations and companies have limited resources. Efficient

effectively	use is therefore essential. Advertising and marketing a product should be aimed at people likely to buy it otherwise it is a waste of time and money. Information about customers' buying habits is valuable here and can lead to an organisation or company becoming more profitable
Monitor and control	Information can help an organisation or company stay informed about how well it is doing. Information obtained by market research (eg people in the street stopping certain passers-by, questionnaires sent to a sample of homes) and sales figures can help to achieve this. Monitoring helps ensure that the use of resources is cost-effective
Gain advantage	Information can tell an organisation how well it is doing compared to its competitors. For example information can identify gaps in a particular market which can then, on the basis of sound information be filled.

The value of good information is essential to the success of an organisation or company, but there are costs involved in producing this information, as listed below:

Collecting the data	<p><b>Data collected directly</b></p> <p>The organisation or company has to produce a way of collecting information eg creating forms, questionnaires, sampling etc. In the case of forms and questionnaires, these will have to be printed, sent out and collected. Not all people respond to forms or questionnaires so many <b>more</b> will have to be sent out in order to get a fair sample back. Often, an incentive is given to encourage people to respond eg your name being entered into a free prize draw if the form is completed and returned.</p> <p><b>Data collected indirectly</b></p> <p>The organisation may have to buy the information or pay a third party to gain access to data.</p>
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<p>Data entry</p>  <p>OMR form</p>	<p><b>Keying in</b></p> <p>Data keying takes time and staff will have to be paid to do it.</p> <p><b>Direct input</b></p> <p>There are automated methods of data entry - optical mark readers (OMR), optical character recognition (OCR), bar code readers, etc. Specialised hardware/software needs to be purchased and staff trained to use them.</p>
<p>Data processing</p>	<p>Once the data has been inputted it needs to be processed into information. This requires hardware and software resources. The software may be 'off the shelf' or it may have been developed specifically for the organisation or company. Either way it will cost money.</p>
<p>Data maintenance</p>	<p>There are costs involved in making sure that data remains accurate and up-to-date. For example, an organisation maintains a database of its customers. The database will only remain accurate and up-to-date if changes to customers' details are reported and then updated. This involves communication with customers and checking that their details are correct.</p>

**Importance of up-to-date information**

Processing of data does not stop when information has been collected and inputted into a computer system. As time goes by the data becomes out of date. If changes are made which are not placed on the system, the data can no longer be relied upon and any information obtained from it will be inaccurate

The task of keeping data up-to-date is expensive. Methods used include:

- frequent updating (typing in the changes)
- frequent collecting of data through questionnaires, letters or checksheets



It is no good having a mailing list when the addresses are no longer correct. When people move house, mail continues to be sent to the old address until the relevant mailing list is updated.

Companies who sell their products through direct mail (junk-mail is the more commonly used name!) need up-to-date lists of names and addresses of people who are likely to be interested in their product. An out-of-date list is of no value whatsoever. Remember people move house, grow old, die, and change their interests or buying habits.

### **Value of Information**

The monetary value placed on information depends on

- the accuracy of the information
- the intended and potential uses of the information

When a company decides to purchase information it must make sure that it will reap financial benefits. The costs obtaining the information should not outweigh the benefits gained from the information. A cost/benefits analysis should be made before purchasing data or embarking on data collection. For example, if a company's profit increases by £5,000 as a direct result of information gathering there is no point to it if it has cost £6,000 to get this information.

The information provided by a system should lead to achieving some of the following:

- reducing costs
- eliminating losses
- reducing wastage
- better use of resources
- more accurate decision-making

Information that is collected and stored, but never used has no value since no decisions will be based upon it. It therefore should never have been collected in the first place

Sales information in a supermarket is very valuable as it is used to help decide what to order, whether to promote an item or whether to sell an item at all. Using this information means supermarkets can keep more accurate stock levels and be more efficient.

Sales data is collected directly for printing itemised bills and keeping track of sales and stock levels. With loyalty cards such as the Tesco Clubcard, data may be used indirectly to target particular customers.

### Timely information

Information must be timely – financial markets are subject to rapid change and information systems must react quickly to these changes.

#### Furbies in wilderness at Christmas

Manufacturer: Hasbro



They are cute, cuddly and have a mind of their own and they promise to drive weary parents round the bend. They are Furbies, and these gurgling, giggling and belching toys are set to become the Christmas best seller.

The rush for Furbies heralds the start of the traditional Christmas toy battle that this year promises to be even more heated than usual. Queues formed in toy shops up and down the country to buy the amazingly life-like pets, which cost around £30. But with only 350,000 Furbies available in the UK before Christmas, some children are bound to end up disappointed.

Back in 1998 Furby was the top Christmas toy and it was sought after by children, teenagers and adults! Due probably to the lack of good quality information, not enough of the furry toys were shipped over to the UK. Consequently Hasbro lost a great deal of money from UK sales.

### QUALITY OF INFORMATION

Accessible, accurate and up-to-date information can help to ensure that good decisions of all kinds are made. This is what gives information its value. Data is of poor 'quality' if it is out-of-date, inaccurate or incomplete. A decision that is made with poor-quality or incomplete information is likely to be a bad decision which may have bad consequences for a company or organisation.

Here are the factors that affect the quality of good information:

Accurate	No errors! Even minor errors can lead to poor quality decisions being made eg giving someone a +£5000 balance instead of -£5000
Complete	Information must include all the data that the user needs to make his decision. Nothing should be left out.
Up-to-date	Information should be accurate when it is presented. It should be a true reflection of how things are at the time.
Relevant	Information should not include data that is not needed. Receiving more information than is needed can lead to information overload and the information <b>needed</b> to be able to make effective decisions becomes lost amongst data that is <b>not needed</b> .
Correctly targeted	Information should be presented to the people who need it. Giving information to people who don't need it can lead to information overload. It can also create confusion and could result in confidential information being in the wrong hands
Understandable	Information should be set out in a clear format that is appropriate for the intended audience.
Timely	Accurate information must be available when needed. No decision should be based on 'accurate' information which is 2 weeks old!
Has user confidence	Information should have the confidence of the users. If the user believes the data is inaccurate or the original source of the data is unreliable then the information will be useless to them. No decision can be made based on such information.

### Updating files

Date stamping a file is a means of showing the user when the information was submitted. If a user has 2 versions of the same file on disk, date and time stamping will show which is the most recent.

Frequency of updating files depends on use. Information on the availability of seats on a plane needs to be updated continuously or it could lead to double booking. On the other hand, student details on the school database do not have to be updated immediately.

### HOW TO FIND INFORMATION

Information can be collected from many different sources. Some will be on-line or electronic methods and others from paper-based sources and interviews.

On-Line Sources	Non-ICT Sources
Internet	Newspapers
Intranet	Magazines
CD-Roms	Catalogues
	Text books/Encyclopaedias
	Interviews/Questionnaires

There are advantages and disadvantages related to both methods.

### On-Line Sources

Advantages	Disadvantages
Availability	Expensive to buy/use
Up-to-date	Quality not always guaranteed

Quantity	Difficult to find the right information
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**Non-ICT Sources**

Advantages	Disadvantages
Cheaper (no equipment needed)	Out-of-date as soon as published
Quality assured	Can be bulky or heavy
Easy to use	
Accessible anywhere by anyone	