

The Connected Business

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AI cloud promises a silver lining

Computing is evolving from a mobile-first model to an artificial intelligence-first world, reports *Richard Waters*

Cloud computing is still in its infancy. Most big companies are assessing how far to go in shifting computing tasks into the giant, centralised data centres that form the cloud, and it will be years before most existing computing workloads move to it, if ever.

The case for the cloud so far has been based on its potential to lower computing costs and increase business flexibility. By tapping into a large cloud computing company, such as Amazon Web Services (AWS), clients have hoped to move more quickly and cheaply to increase or decrease their computing resources as their needs change.

However, the cloud is evolving more quickly than many executives realise. "Just about every decade a new platform comes along that completely disrupts computing," says Tom Austin, an analyst at tech research company Gartner.

The most recent change, he says, has involved a combination of cloud and mobile, with smartphones acting as the delivery mechanism for services in the cloud. But this is starting to evolve into the next thing. Mr Austin says this will be the combination of artificial intelligence (AI) and the cloud.

Microsoft currently offers more than 20 such "cognitive services", such as analysing images, known as computer vision, and language comprehension. Cloud-delivered services like these are



starting to proliferate. AWS, for example, has added predictive analytics – data mining to forecast trends – to its cloud services, opening up machine-learning algorithms first developed for internal use (see *Ones to Watch*, page 2).

In May, Google announced that application program interfaces (APIs), tools used to develop software, would be available so others could tap into three of its in-house services: translation, speech recognition and computer

vision. Google said its speech recognition API could turn a client's audio file into a written transcript in 50 languages.

Such technologies have many potential applications. Facial recognition technology, for instance, could lead to

more effective security and access control systems. In retail, this same technology could alert staff to the identity or interests of potential customers and help them make a sale.

Meanwhile, many of the first uses of technology that "understands" language have focused on customer assistance and chatbots, to discover what types of interaction with computers work best in conversational form.

This has been followed by experiments with language capabilities. These are being embedded in many intelligent agents, such as digital personal assistants and chatbots, to discover what types of interaction with computers work best in conversational form.

Satya Nadella, chief executive of Microsoft, calls this approach "conversation as a platform". It is a development that could be more significant than the touchscreens that triggered the smartphone revolution.

For example, voice-responsive AI systems now handle fairly simple customer requests, like dealing with minor banking queries or ordering a pizza. The next probable step is to develop voice AI services so they can integrate information from different sources, such as digital diaries, online maps and corporate websites, and co-ordinate meeting friends and car rides with visits to restaurants and cinemas for users.

Sundar Pichai, chief executive of Google, speaking as his company reported its latest earnings in April, expressed great hopes for AI. Machine learning, whereby computers teach themselves, and artificial intelligence are technologies his business has invested in for years. Mr Pichai said they have now reached a point where they

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The Connected Business

Dropbox, Facebook and their like move into the office

Services Business-friendly versions of apps are appearing in the workplace, says *Jessica Twentyman*

Like more than half a billion people in the world, Chris Burgess, vice-president of IT at Expedia, the online travel company, has a Dropbox account. He signed up for the cloud-based document service as a consumer in 2008, thinking it would allow him to access and share files via his smartphone when he was on the move.

Over time, however, it became clear to him that many Expedia employees were also using Dropbox's services for work, leading to concern that the company had little oversight about what corporate information they were sharing over the service, or with whom.

"We knew we needed more control," says Mr Burgess. "The biggest problem with some of these consumer-focused apps in the workplace is that no one is in charge."

Last year, Expedia signed up for a paid business version of Dropbox and aims to have 10,000 staff using it by the end of 2016.

The corporate version lets users distinguish between personal and business documents and it includes features and functions that give IT teams more direct control over company information. They can encrypt documents, for example, or limit how certain types of file are copied and shared.

Many companies face similar choices. Employees may be using Google Drive to create reports and presentations, Skype to stay in touch with the office or WhatsApp to message team members. These apps are familiar, easy to use, work well on mobiles and are typically free for lightweight consumer use.

Aside from the lack of corporate control, however, there are the added risks that mobile devices might be lost, stolen or fall prey to hackers and viruses. As a result, many companies still ban the use of consumer apps at work.

Last year, mobile device management software company MobileIron polled its 10,000 corporate customers to find out which apps were mostly likely to be forbidden.

The top-10 names on company blacklists were Dropbox, Angry Birds, Facebook, Microsoft's OneDrive, Google Drive, Box, WhatsApp, Twitter, Skype and SugarSync.

"Consumer apps frighten IT departments because corporate data can wander away," says Mike Raggo, MobileIron's director of security research.

This is a perfectly legitimate concern, but companies can still find it hard to tackle workplace use of consumer apps because so much of it takes place under the IT department's radar.



Thumbs up: Facebook wants to make money from enterprises — Chris Ratcliffe/Bloomberg

For the vendors of consumer apps, meanwhile, businesses represent an increasingly attractive target, a way to monetise their products and services, as long as they can be accompanied by the kinds of corporate security features that IT teams are looking for.

At the last count, about 150,000 businesses were paying for Dropbox for Business. Dropbox Enterprise offers IT teams further ways to monitor employees' use of corporate accounts, as well as integration with more business-focused content security tools.

Google, for example, offers a range of business services that are used by companies including Jaguar Land Rover, pest control business Rentokil Initial and UK-based fashion retailer AllSaints.

Meanwhile, social platform Facebook is rolling out Facebook at Work, a company-friendly version of the social networking site for employees, which the Financial Times for one is already using.

The challenge for companies such as Dropbox, Google and Facebook, however, is how to shake off their consumer-tech images and persuade corporate IT decision makers to make the switch.

But budget holders are not always inclined to do so, often because of existing investments in traditional enterprise software for communication and collaboration.

One sales tactic is to point out that these are applications that are familiar to employees, support modern ways of working and are designed with mobile use in mind — advantages over many older corporate systems.

This employee-centred pitch addresses the problems of encouraging uptake and providing the training needed for many corporate software systems, because, says Rob Baesman, head of product for Dropbox Business, "employees already know and love these apps".

That seems to be a pretty powerful argument to many. According to William Kim, chief executive of AllSaints, the decision to start using Google's enterprise services internally was not driven by security concerns, but rather by the user experience it wanted to offer its 3,200 employees, who are scattered across stores and regional offices in 20 countries.

"Around the world, consumers are adopting innovation at a far, far faster pace than companies," says Mr Kim.

"Corporate IT is struggling to keep up, because it frustrates employees. It simply doesn't support the ways they want to work — and they increasingly find that they far prefer the technology they use as consumers, in their time, outside of work."

Confusion reigns over privacy deal

Data protection

Watchdogs find fault with 'Safe Harbour' replacement, writes *Jessica Twentyman*

Since 2000, US cloud providers have relied on the Safe Harbour agreement with the EU. This assured the providers and their European clients that employee and customer data sent to US-based servers would be subject to the same data protection rules as if they were kept in Europe.

So when the European Court of Justice ruled last October that the Safe Harbour accord was invalid as it did not do enough to protect that EU data from US government surveillance, those same cloud providers rushed to assure their customers that they were on top of the situation.

For one provider, NetSuite, the timing could not have been better. The day Safe Harbour fell, Zach Nelson, the chief executive, was in London to announce plans to open data centres in Dublin and the Netherlands. This, he said, would enable the company's customers to keep data on their employees and customers on EU soil.

Other cloud providers made similar moves. Amazon's chief technology officer, Werner Vogels, said in a blog post that the company's Amazon Web Services hosting business would open its first UK-based data centre — its third in the EU — by early 2017. Microsoft also unveiled plans for two UK data centres for its Azure cloud business.

But not every US-based cloud provider offers EU-based data centres and even those that do may not be immune to legal problems in the future, warns Nicola Fulford, head of data protection and privacy at law firm Kemp Little.

Microsoft, for example, is embroiled in a long-running dispute with the US government over requests to see emails held in its Irish data centre. The US government argues that US-based companies have a legal obligation to comply with such requests, regardless of where data are stored. More worrying still for

European cloud customers and their US suppliers, Ms Fulford says, is continuing uncertainty over an acceptable replacement for Safe Harbour.

In February, the EU-US Privacy Shield agreement finally emerged after much wrangling between Brussels and Washington. The deal is expected to come into effect from June this year.

However, in April a group of national data protection watchdogs known as the Article 29 Working Party rejected Privacy Shield, announcing that, in its current form, the deal is not robust enough to get their support.

The FT reported that the regulators had criticised the agreement for failing to limit "massive and indiscriminate" collection of data by US authorities and for not guaranteeing the independence of an ombudsman who will deal with complaints from EU citizens.

"The path for adoption of the Privacy Shield was never expected to be easy, but the breadth and specificity of the



shortcomings perceived by [the Article 29 Working Party] will make subsequent legal attacks significantly more likely to succeed, even if further negotiations between the US and EU can find ways to address the problems," says Robert Cattanach of law firm Dorsey & Whitney.

"It's difficult for customers who want to move forward with cloud deals and difficult for vendors who want to keep signing deals," adds Ms Fulford.

Companies are left to fall back on contractual mechanisms to safeguard data, which are complex and expensive to put in place and still cannot offer guarantees in a shifting legal landscape.

"The real impact could be on potential customers who may hesitate to upgrade to modern, cloud-based business systems," says Mr Nelson of NetSuite. "That's bad for the European economy."

AI cloud holds the promise of a silver lining

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will start to have a far greater effect on the company and its cloud customers.

"I think we will evolve in computing from a mobile-first to an AI-first world."

If you accept this view, moving data storage and computing to the cloud will be only the first step in a far bigger transition. Once liberated from the confines of internal IT structures, companies will find other benefits, such as tapping into more varied feeds of data and accessing intelligent services.

With such capabilities, the thinking goes, companies will be able to infuse their own services with this intelligence thanks to the "AI in the cloud". Using the public cloud to provide services over the internet is the first essential move. "You have to use the cloud to access large pools of publicly accessible information," says Gartner's Mr Austin.

According to Eric Schmidt, chairman of Google's parent company Alphabet, operating in the cloud will allow companies to grow rapidly by tapping into crowdsourced data, from social media for example. Having access to machine learning and other forms of AI that companies like his can provide means the next truly disruptive businesses will emerge from this potent mix, he said.

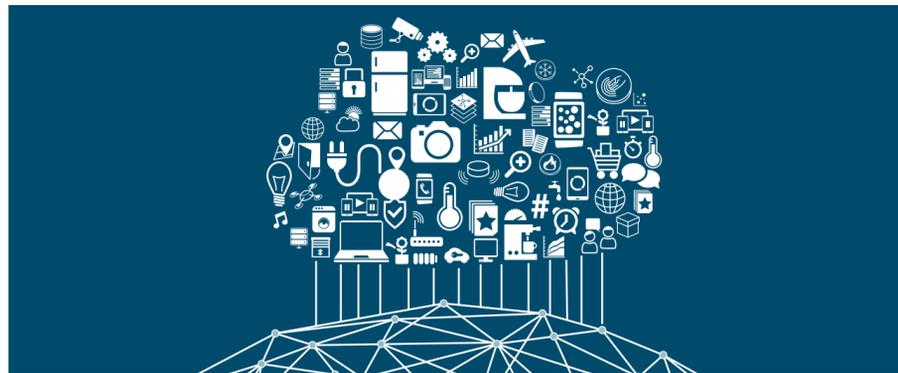
The big computing companies are looking ahead to the emerging fight. Google, for instance, has been an also-ran in cloud computing so far. It relaunched its cloud services this year, with the admission that it had not found the right approach to appeal to potential customers.

The company is trying to persuade possible clients to look ahead to the era of AI in the cloud, saying it will usher in a different way of using computers, according to Mr Schmidt. "It's clear to me [AI] is going to be the foundation for the next layer of programming," he said in March.

Echoing the late Steve Jobs, he called this the "one more thing" — the unexpected bonus that would outshine all other benefits of moving to the cloud.

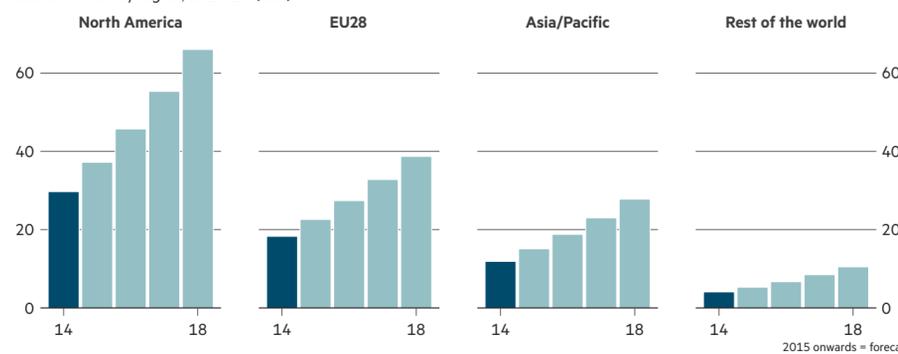
Other big tech companies are also staking out their claims to this emerging world. "I think that, for us, we will obviously battle with the best of them on AI," says Microsoft's Mr Nadella, before suggesting his company and Google are probably ahead in this field.

Heads in the clouds



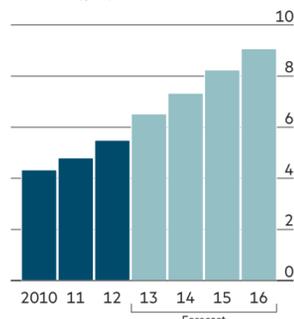
Enterprise cloud computing

Global revenue by region, 2014-18 (€bn)



Cloud services

E-commerce enablement revenue, 2010-16 (\$bn)



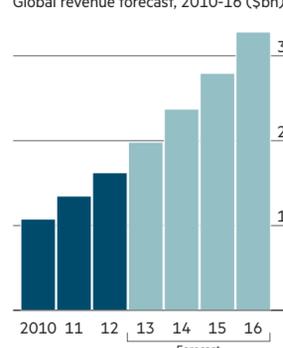
Public IT cloud services*

Global market growth, 2011-16 (%)



Software as a Service (SaaS)**

Global revenue forecast, 2010-16 (\$bn)



* Such as apps and storage ** Licensed software paid for by subscription

Sources: Statista; Forbes, Gartner, DigiWorld Yearbook 2015/Date

Image: Dreamstime

The potential uses for AI will affect many industries, from car manufacturing to pharmaceuticals, says Kara Sprague, co-head of cloud practice at consultants McKinsey.

"These are all fascinating use cases that will require large amounts of data and they'll rely on the public cloud," Ms Sprague adds.

When the smartphone revolution

took hold, many in the tech world predicted that entirely new and disruptive businesses would result, even if it was difficult to predict exactly what they would be.

One result was Uber, a company that operates in a market few had thought would be overturned by digital technology. Something similar is likely to lie ahead with the emerging AI in the cloud,

according to Google's Mr Schmidt. As always with big technological shifts, however, much will depend on timing. The greater the hopes, the more chance of disappointment for the unwary.

"I worry about a deep depression in this space as we go into the next hype cycle," says Mr Austin. "But on the other hand, it will be revolutionary."

Tap into powers of big tech companies

Ones to watch

The number of intelligent services on offer is increasing, writes *Richard Waters*

What if you could tap into the same level of artificial intelligence (AI) that the most advanced consumer internet companies use to run their services?

The answer, apparently, is you can. That, at least, is the promise behind some of the "machine learning in the cloud" services that are now becoming widely available.

Amazon Web Services (AWS), for instance, added machine learning — the ability for computers to learn without programming — to its list of available services last year. This gives customers the ability to apply the same algorithms to their own data that Amazon has used internally for fraud detection and to drive its website recommendations.

The online retailer had set up a centralised machine learning unit to develop the technology and make it available to internal developers, says Matt Wood, general manager of product strategy at AWS. It was then relatively straightforward to open up the service to outside customers.

Companies that store their data in the AWS cloud can now build AI models and train them using data they supply. These models can be used for predictive tasks such as forecasting demand or anticipating how customers will behave in certain conditions.

"Once customers start to apply predictive models to their data, it becomes addictive," says Mr Wood.

IBM, through its Watson "cognitive computing" division, also provides AI services. The platform uses natural language processing and machine learning to interrogate large amounts of clients' unstructured data.

AWS's size means it can offer low unit costs while handling the large amounts of computing power that are needed to run such predictive data models, Mr Wood says.

When it comes to the most advanced forms of AI, however, Amazon is a "junior player", according to Tom Austin, an analyst at Gartner.

He says Google and Microsoft are further ahead in the field of deep

machine learning, as are Facebook and Chinese company Baidu. And it is deep machine learning — a technique that uses so-called neural networks, modelled on the human brain — that could offer the greatest potential.

Jeff Dean, a lead engineer at Google, says neural networks can reach conclusions automatically by trawling through large volumes of raw data without needing the sort of human guidance standard machine learning algorithms require.

Turning this into a practical, everyday business tool poses challenges, however. One is time. The amount of computing required to train the technology on a new data set can be

'Once customers start to apply predictive models to their data it becomes addictive'

a barrier to practical use. At Google, engineers working on such exercises hit the "patience threshold" where frustration sets in after around four or five days, says Mr Dean.

A further difficulty lies in making the technology available in a way that it can be applied easily by other developers to their own problems. "How we can package that up and make that easier to use is a question we've been wrestling with within our group," Mr Dean says.



Forward thinking: Matt Wood

The Connected Business

Pupils told to 'bring your own device' as cuts bite

Education

Fears that schoolchildren will be distracted by phones and tablets have not been realised, says *Jane Bird*

Schools in the UK are starting to ask pupils to "bring your own device" to class. So far only 29 per cent of UK secondary schools have opted for some form of BYOD, according to a 2016 survey by RM Education, a supplier of computer products and services.

However, the number considering adopting the policy has risen from 22 per cent in 2014 to 26 per cent this year.

By comparison, only 9 per cent of UK primary schools have adopted BYOD in the same way. "It works well for older pupils who are pretty self-sufficient and can fix the simple things that go wrong," says Steve Forbes, an RM networks specialist. As budget cuts hit, more secondaries may consider BYOD, he adds.

Schools have taken a variety of approaches, from specifying which gadget to buy to saying pupils can bring any device that can access the internet.

Mr Forbes says BYOD is more developed in continental Europe, where pupils use low-cost Android devices. In the US, schools, districts or states tend to specify Google's Chromebook or the Apple iPad, which are designed to require low levels of IT support, he adds.

Advocates say student BYOD increases engagement and makes it

easier to transfer work between home and school. Pupil motivation is often improved, adds Chris Sessums, programme director for research and evaluation at the Center for Technology in Education at the Baltimore-based Johns Hopkins University.

He says teachers often worry BYOD will "create terrible problems with pupils texting and sexting [sending nude images of themselves or others] in class" and not focusing on lessons.

Such fears are usually unwarranted, Mr Sessums says. "Those who thought it would never work and have tried it for a year have found that pupils can learn the ground rules. Besides, even adults are not 'on-task' the whole time."

Having many devices in class can help develop collaboration skills, such as assigning roles to team members and learning to share, he adds. "On a joint project, a pupil who has a cell phone or smartphone might do some research or fact checking while a pupil with a laptop or tablet does the initial write-up."

The emphasis on internet access, rather than specific devices, is consistent with the move in education towards cloud-based services that can be used from home as well as the classroom.

BYOD does not necessarily save money. It can reduce spending on hardware, but it increases overheads such as internet infrastructure, software licensing and technical support. This can cost up to £100,000 for a large UK school.

More bandwidth or additional access points might be needed to ensure students can go online because handheld devices have a shorter WiFi range than powerful notebook computers.



Modern learning: schools come of age

Matt Britland, director of ICT at Lady Eleanor Holles School in London, says: "If the internet is unreliable and not fast enough, or WiFi is very slow, it will go pear-shaped and not be used."

Another problem is that some families cannot afford to buy devices. Some UK schools dip into pupil premium funds – additional money for disadvantaged pupils in state schools – to subsidise computers for the less well-off.

Because of tight budgets, schools have to be creative, says Mr Sessums. For example, they could go to organisations such as banks that refresh machines every three years and ask for the old devices. "The children could even be taught how to upgrade the machines as part of their learning."

Even if children bring devices, all the content they see still needs to be filtered as it would be for any device used in school, adds Mr Britland.

"We can use software to turn the camera off, enable teachers to use classroom management tools and distribute and remove apps. The school web filtering can also block social media services such as Snapchat and Instagram."

However, those with 3G or 4G smartphones can access anything they like unless their parents have applied parental controls and filtering.

Some schools that provide iPads use Apple's "device enrolment programme", which customises iPads to preset specifications.

Known as "supervised" devices, these are available to parents from suppliers who provide an educational discount. Once pupils leave school, this supervision can be switched off.

Prospect of sexual relationships with robots poses moral dilemmas

ON TECH

Maija Palmer



Could we fall in love with robots? Movies have been suggesting the possibility for some time, from a man falling in love with his computer operating system in the 2013 film *Her*, to robot lover Gigolo Joe offering his services to women in 2001's *A.I.*

We are on the cusp of creating loveable robots. Leaps in artificial intelligence are making conversations with automatons less stilted, for example. One Silicon Valley company, Eternime, plans to let people create avatars of themselves that learn their speech patterns and life stories, then converse with loved ones after death.

And robots themselves are becoming increasingly lifelike. The University of Science and Technology in Hefei, China, recently unveiled Jia Jia, an attractive humanoid robot that can respond to speech and whose facial movements look natural. Ricky Ma, a Hong Kong-based inventor, created a robot that looks a little like Scarlett Johansson. She smiles, winks and responds to compliments.

Neither robot has been built for sexual purposes. However, there already exists a niche but lucrative industry in creating realistic sex dolls. California-based Abyss Creations has a line of RealDolls, humanoid figures with high-quality silicone skin and moveable limbs, fully customisable in different skin tones.

The company's dolls do not move, speak or stand up without support. Despite this, founder Matt McMullen revealed last year on the website Reddit that he was working on ways to build artificial intelligence into the dolls.

Relationships, sex with and even

No dummy: Jia Jia can speak and looks realistic

marriage to robots could be normal by 2050, says David Levy, artificial intelligence expert and author of the book *Love and Sex with Robots*.

He points out we can already become fond of pets and inanimate objects, such as cars or computers. So why not robots? He further adds that the reasons humans fall in love with each other can also be broken down into fairly mundane components, such as proximity and similarity.

"If a robot is acting in ways that are very strongly reminiscent of humans, and if it gives something back – if it is providing great sex and interesting conversation – you can understand its owner getting attached to it."

Some argue that sex robots might benefit society, replacing trafficked human sex workers, for example – just as industrial robots take on tasks too

dangerous or dirty for human workers. But the prospect horrifies Kathleen Richardson, senior research fellow in the ethics of robotics at De Montfort University in the UK.

"I am worried about the impact on human relationships," she says. "It is introducing the idea that human relationships are optional, that you can have all your needs met by a machine. But that is not true. You need other human beings."

Despite talk of intelligent machines, at the heart of this debate is the nature of love. When we talk about robots – in love or replacing us in the workplace – we are often expressing our concerns about other things, such as the nature of male-female relations.

For example, Ms Richardson, who has founded the Campaign Against Sex Robots, proffers two arguments against sex bots. One is to do with the fact that most sex dolls resemble women and are bought by men – although male dolls are also available. Ms Richardson is concerned that, much like the proliferation of pornography on the internet, female sex robots will dehumanise women.

Creating objects that closely resemble human females, she argues, leads men to regard women as objects. The other problem is that relationships with machines stunt our own emotional development.

"We need social interaction with other people," says Ms Richardson. "It is what makes us human."

Others keep us in check and teach us to negotiate and reciprocate. A relationship with a machine, programmed to obey our every wish, could turn us into spoiled children, unable to function with other humans.

Mr Levy, however, argues that robots would not replace human relationships but instead offer a substitute for those who cannot form them – severely disabled people, for example, who might struggle to find a sexual partner.

"The question isn't whether a relationship with a robot is better, but whether it is better than no relationship at all," he says.



Curriculum experts say coding is essential in a digital economy

Employable skills

Developing computational thinking helps students to better understand the world around them, says *Jane Bird*

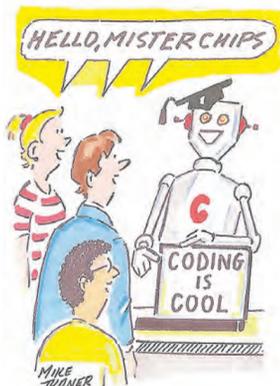
Many of us happily drive a car without understanding what goes on under the bonnet. So is it necessary for children to learn how to program computers? After all, some experts say coding is one of the human skills that will become obsolete as artificial intelligence grows.

Nevertheless, governments believe coding is an essential skill. Since 2014, the principles of computer programming have featured on England's curriculum for children from the age of five or six, when they start primary school.

In the US, President Barack Obama launched Computer Science for All in January, an initiative aimed at giving every pupil from kindergarten to high school programming and coding skills "that make them job-ready on day one". He even took coding lessons himself.

While not all children will become programmers, Mark Martin, a computing teacher at Sydenham High School, London, argues that they should learn to understand what makes computers work and try to solve problems as a computer might. "Lots of our pupils are consumers of software but don't understand how it works," he says.

The computer science GCSE, introduced in September 2014 to replace the information and communication technology (ICT) exam, includes coding and has been incorporated into the English baccalaureate, a performance measure of how many pupils aged 16 obtain a grade C or above in the core academic subjects in government-funded schools.



"The ICT exam showed pupils 'how to drive the car', while coding in the computer science syllabus shows them 'how the car is made' and 'how to design a car'," Mr Martin says.

Jim Flanagan, chief learning services officer at the US-based International Society for Technology in Education, agrees that coding should be on the curriculum. It should not be seen as an end in itself, he says, but it should be taught because it is an important piece of knowledge in the digital world.

"The beauty of learning to program... is you understand the core elements of computer science. That remains true even if the language you learn subsequently becomes obsolete."

Computational thinking involves algorithms, abstract models, data analysis, extracting key information and dealing with complex systems. Students tackle problems step by step and learn from their mistakes.

If you want to lead an organisation in the 21st century, or even just run a project or team, you cannot consider computing to be "just a technical matter", says Mr Flanagan, because

the world is increasingly being run using digital systems.

"Just because something was developed by humans and is on the internet doesn't mean it is right," Mr Flanagan adds. "People need to understand how that information was generated and whether to trust it."

Although coding may seem technical and daunting, enthusiasts say that it can also be fun, collaborative and applied to a wide range of subjects. Programming can be used to tell stories as part of creative writing in English, to devise solutions to environmental problems in geography, and to create presentations or role-playing games in personal, social, health and economic education.

Some see it as being similar to learning to write in a particular form, such as iambic pentameter. It also provides much-needed practical skills for employers. President Obama's initiative came about partly because up to 600,000 high-paying tech job vacancies across the US were not filled in 2014.

Coding is also a subject at which the UK's students need to improve, says Mr Martin. "We're seeing so many people setting up tech companies that we more need developers. But young people won't get a job from just swiping their finger on a screen to control an app."

Anita Chandraker, head of digital delivery at PA Consulting, began her career as a programmer. She says the lack of coders holds the company back. "It's very hard to find the people we need to achieve our target growth."

As a result, PA runs a competition for pupils aged 7-18 that challenges them to create devices, games or apps to develop their coding skills. "Children should be exposed to programming and understand what it is and the difference between, say, programs to control a robot compared with creating a website," Ms Chandraker says.

Contributors

Richard Waters
West Coast editor

Maija Palmer
Social media editor, Special Reports

Jane Bird
Freelance journalist
Jessica Twentymann
Freelance journalist

Adam Jezard
Commissioning editor

Valentina Romei
Statistical researcher
Chris Campbell
Graphic designer

Steven Bird
Designer

Alan Knox
Picture editor

For advertising details, contact:
Robert Grange, +44 (0) 207 873 4418
email robert.grange@ft.com, or your usual FT representative.

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