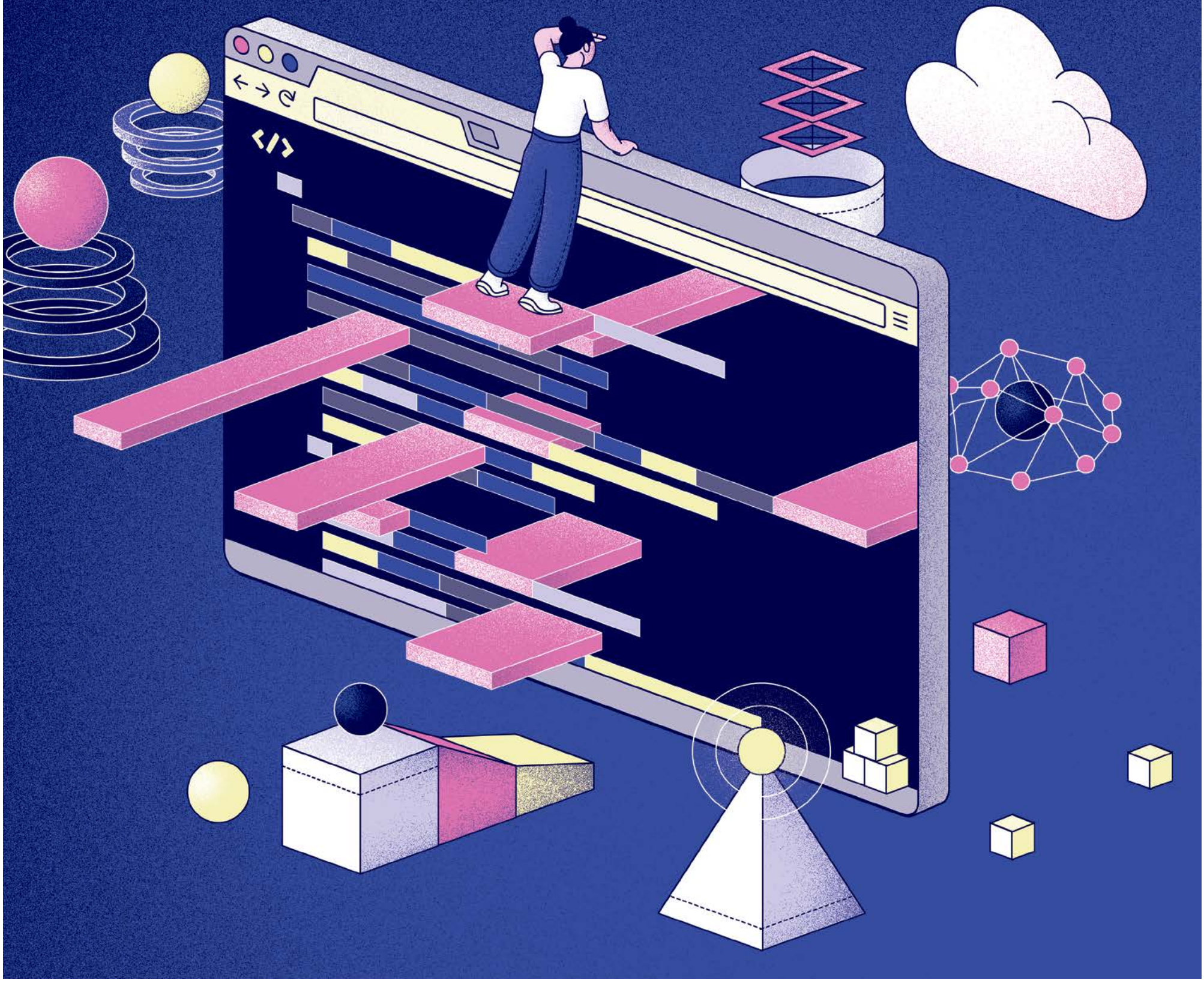
THE FUTURE CTO



THE FUTURE CTO

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TRENDS

The changing role of the CTO

The chief technology officer sets a business's tech strategy in the same way that the CEO sets the business strategy. But internal and external pressures mean the role is set to change and grow

Jonathan Evans

When it comes to technology, the risks of businesses falling behind the curve are clear. Indeed, in the aftermath of the 2008 financial crisis, numerous legacy businesses were caught on the hop by nimble, digital-first disruptors – the transformation of the taxi industry through ride-sharing apps is a prime example. Meanwhile, startups such as Airbnb and Venmo began using emerging technologies to dissolve the boundaries between industries and create new business models.

The rate of digital disruption has only increased in the years since. The outbreak of Covid-19 is estimated to have accelerated the widespread adoption of digital technologies by several years, dramatically increasing the number of internal and external threats that businesses face.

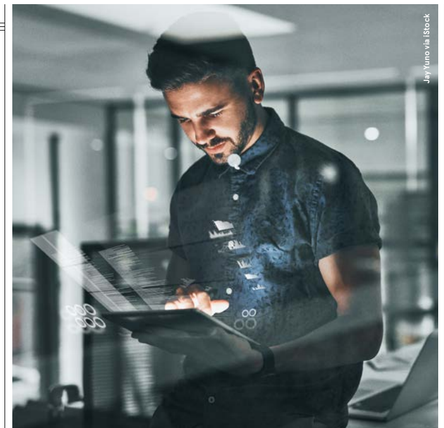
Chief technology officers (CTOs) are on the front line of addressing these challenges. While there are variations in what the remit of a CTO includes, they are usually responsible for managing and driving value from technology within an organisation. In other words, they must monitor any emerging, disruptive technologies and turn these threats into sustainable opportunities for their business.

James Donkin is the CTO at Ocado Technology. He believes that the dizzying speed of technological change in the past decade has greatly expanded the strategic function of his job. "In the past few years, we've seen the role of the CTO become less siloed as technology has become more ubiquitous. A modern-day CTO works across the business, supporting and advising multiple functions.

Today, CTOs are strategists, working with the leadership team to build business plans and roadmaps that align with the wider company vision, he says. "To do this, it's crucial for CTOs to have a deep knowledge of the trends and emerging technologies which could give their organisation an advantage."

And what seems to separate the best businesses from the rest is the inclusion of the CTO in company-wide decision-making. A recent McKinsey study found that nearly three-quarters of top-performing companies highly involve their most senior tech leaders in setting the overarching company strategy.

The increasing strategic importance of the CTO is unsurprising given the significant threats that technology poses to businesses. Take cybersecurity: the widespread adoption of mobile and cloud platforms, partly necessitated by the pandemic – plus the increasing use of emerging technologies as a competitive advantage – has dramatically increased a business's attack surface for hackers.


Jay Yuno via iStock

CTOs are at the forefront of setting a company's strategy for combating cybercriminals, according to Yvonne Bernard, CTO at Hornetsecurity. She notes, though, that widespread hybrid working has complicated a CTO's ability to counter hackers.

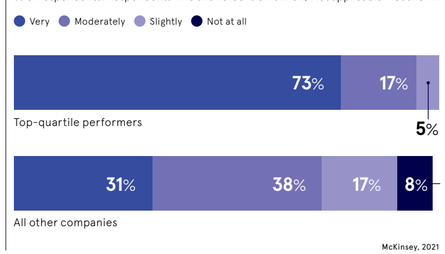
"The pandemic has forced lots of companies to accelerate their digital transformation and flexible working policies, which, in turn, has led to changes in leadership styles and communication with team members," she says.

As a result of changes to communication channels, new paths opened up for hackers to mount cyber attacks. "For instance, people are unlikely to 'go over' to their colleague if there's a potential phishing email, and they are less likely to pick up their phone," says Bernard.

Of course, cybersecurity is just one area of a CTO's work that has been complicated by recent changes to working behaviour. Alongside these internal challenges, CTOs are also grappling with changing customer habits.

TOP-PERFORMING COMPANIES ARE MORE LIKELY TO INVOLVE THEIR CTOS IN BIG DECISIONS

Level of most senior technology leaders' involvement in business decisions, % of respondents. Respondents who answered 'Don't know/Not applicable' not shown.



McKinsey, 2021

During the peak of Covid-19 in 2020, ecommerce was pretty much the only option available to customers for their everyday necessities. But now, with the worst of the pandemic hopefully behind us, this digital growth has started to plateau as customers spend less time within a company's online channels.

Retaining these customers will be high on the priority list for most business leaders, particularly given the ongoing economic disruption. To achieve this, businesses will have to invest in improving the areas that matter most to digital consumers, namely user experience, security and privacy.

CTOs will likely be responsible for overseeing these digital innovations. Austin Sheppard, CTO and vice-president for trips engineering at Booking.com, believes that tasking CTOs with such an important job reflects their changing function. The job is no longer a purely technology-focused role, he feels. Instead, it is a strategic position that has a company-wide significance.

"A decade ago, the CTO was generally more of a back office and support role than it is today," he says. "It's now much more likely to be a position that plays a key role in strategy, operations and business decisions at most companies.

"When you look across industries, the CTO is evolving into a 'front-seat' executive, alongside the chief financial officer, the chief marketing officer and the chief operating officer."

The CTOs of yesteryear tended to have a traditional engineering background. Although that equipped them with in-depth technical knowledge, it perhaps left some lacking the strategic skills that other C-suite leaders had gained over the course of their more varied careers.

But given the increasing use of technology as a competitive differentiator between businesses, the required skill set of a CTO today is changing. While they still need to have an in-depth knowledge of technology and emerging trends, they also need to have the strategic vision to set a course for a company that mixes today's technologies with the digital trends of tomorrow.

Jason Foster, CEO and founder of data and analytics consultancy Cynozure, agrees. "As businesses become more and more technically driven, it's likely that we'll see an increase in the number of CEOs from a CTO background. CTOs are key strategic allies for CEOs and deserve a seat at the top table."

Commercial feature

Outsourcing will drive the next IT revolution

Propelled by economic uncertainty and a talent crunch, CTOs are turning to outsourcing, yet this approach is only effective with the right partner

Amid post-pandemic woes and the cost-of-living crisis, energy price spikes and the tech talent shortage, many industries are living in volatile times. Yet one thing's for sure, businesses still need a pipeline of skills, capabilities and the right people to deal with change. Scaling technology-led initiatives is also seen as an answer, vital to future-proofing firms, yet delivering on all these aspects is now a real challenge.

The fallout of Covid-19 means that demand for hybrid and remote working is still sky-high. Wages and inflation have been soaring, while workers are difficult to hire and retain. This is why managers have become adept at overseeing distributed workforces. This has created a demand and willingness for outsourcing, as CTOs continue to roll out ambitious digital transformation programmes.

In a recent survey of 300 IT leaders, 64% of companies said they had adopted a new outsourcing strategy due to the global pandemic. 54% are now outsourcing to gain access to talent and save on costs, while 41% polled are outsourcing to bring in new knowledge, tools and experience. As the economy enters a turbulent period, deploying tech consultants can be a useful tool when it comes to delivering business resilience and agility.

"CTOs still need to deliver on multi-year, long-term projects despite all the current issues. If their businesses are to grow tomorrow, they also need to be able to try out and scale new software solutions or digitally transform, without the risk of deploying huge tech teams in house today," explains Vlad Nanu, co-CEO of Amdaris, which is one of the fastest-growing UK software development companies and a digital transformation specialist.

"However, just like at the beginning of the pandemic, there is a level of heightened uncertainty right now, but the direction of travel is still the same. All industries, whether that's healthcare, the legal profession or publishing, are in the process of transforming digitally. It is why enlightened players are looking for more flexibility, and cost-effectiveness when it comes to their technology solutions."

Scaling from two to 25 to 100 developers and back again on demand is not possible with in-house tech teams in the current talent crunch. But if digital projects become successful then this kind of scalability is needed quickly if businesses are to be competitive. This involves locating hard-to-find talent at lightning speed. This demand may also be project-based and need to flex. Outsourcing can meet this need, yet finding the right partner who understands a business's priorities is crucial.

"In the past, offshoring software development, say to Asia, has given businesses an advantage. But now digital transformation and IT projects are more complex, real-time solutions are needed that are tailored to local markets so nearshoring makes more sense," states Andy Rogers, co-CEO of Amdaris, which employs over 700 developers in the UK, Europe and the Middle East, working with the likes of Knight Frank, Pearson and musicMagpie.

Increasingly, businesses also want to partner with a software developer that they can learn from, who can deliver value-added services, long-term solutions and deploy diverse talent pools which think differently about problem-solving.

There is an increasing realisation that innovation in newer technologies, whether it involves 5G, AI or blockchain, also requires innovative and disruptive thinkers. Gone are the days of simply implementing prescribed and rigid systems set out by management consultants. Trial and error, agile ways of working, continual A/B testing, co-creation and refinement of a minimal viable product are vital.

"That's why we're working with hundreds of developers. We've teamed up with local universities and schools in our delivery centres, we also run programmes where we have female ambassadors and promote women and individuals from diverse backgrounds in technology. We set our own diversity goals for our large outsourcing teams. This is not easily possible with smaller in-house tech teams," details Rogers from Amdaris, which was recognised as 'business of the year,' in the UK's South West recently.

In the same poll of IT leaders, 74% said they believe that outsourcing partners can now help improve or adopt better software development practices, for example agile delivery, quality auditing and technical excellence. Outsourcing partners can also offer value-added services beyond mere coding, whether that's product design or business analysis, stakeholder management or project planning.

"Right now, there is a lot of interest in drawing experiences, know-how and innovation from one industry and embedding it into another. Whether it is legal services and insurance learning from ecommerce or education adopting practices from service sectors. Today, outsourcers, as opposed to in-house tech teams, are in the best position to cross-fertilise with their ideas, blue-sky thinking and ideation to disrupt industry norms. They do this using knowledge gained in other sectors and do so in a cost-effective way," points out Nanu. Amdaris has averaged 40% a year in growth in revenue and headcount, with teams in the UK, Romania, Moldova, Ukraine, Bulgaria and Dubai.

The situation CTOs will have to deal with going forwards is only going to become more difficult. Talent attrition and loss of institutional memory are significant for those with digital skills. The same poll found that 36% of tech and software developers are looking for new opportunities within the next year. More than a third of this workforce could be on the move. Almost half say their roles are busier since the pandemic – burnout and churn are inevitable.

"It's why outsourcing is now a no-brainer. It's about the three Rs: Reliable expertise that's on tap. It's about developing resilient organisations, who need to be agile and adapt to new market conditions with velocity. Then there's resourcefulness. Partnering with the right outsourcer means you have access to a whole host of talent that can drive disruptive innovation," says Rogers.

"Times have changed," he adds.

64%

of companies have adopted a new outsourcing strategy due to the global pandemic

54%

are now outsourcing to gain access to talent and save on costs

41%

are outsourcing to bring in new knowledge, tools and experience

Amdaris, 2022

> **Propelled by economic uncertainty and a talent crunch, CTOs are turning to outsourcing, yet this approach is only effective with the right partner**

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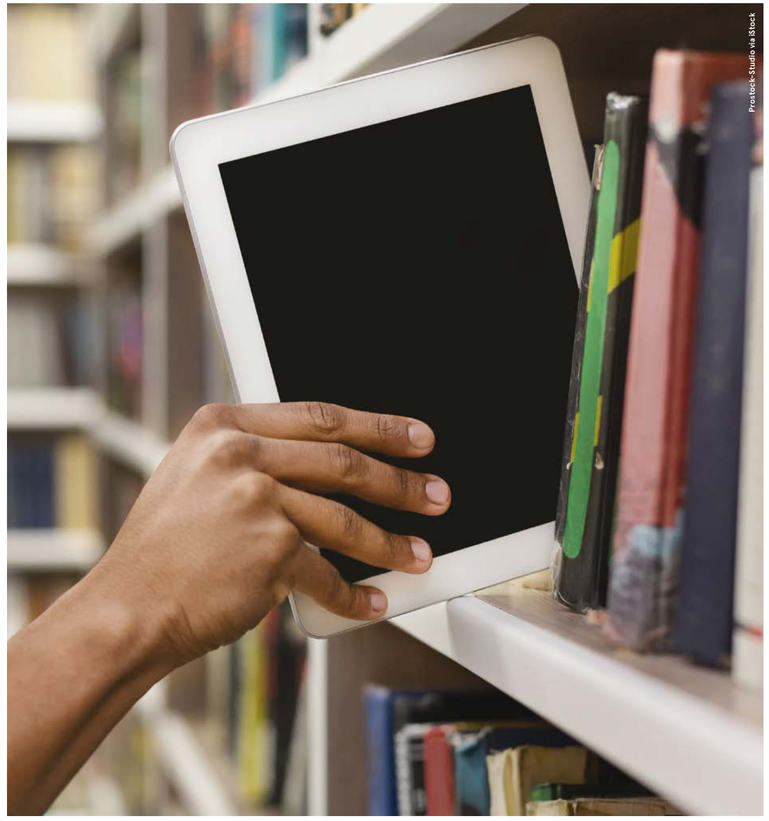

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> **KM is couture for data – it's made to measure – and good KM should be both intentional and invisible**

STRATEGY

Made-to-measure data location

Knowledge management is where technology and people combine for a tailored management of assets. It could also help to unlock potential in your organisation

Annette Corbett

Search for a description of knowledge management (KM) and you're likely to have a better chance of finding an agreed version of the best Avenger hero. Atlassian describes KM as "the process of creating, curating, sharing, using and managing knowledge across an organization, even across industries". Gartner takes a similar view, positing that "KM promotes a collaborative and integrative approach to the creation, capture, organization, access and use of information assets, including the tacit, uncaptured knowledge of people" – but there still remains no single, accepted definition.

This positions KM as an esoteric discipline but consensus suggests that when it is implemented effectively, KM is a collective endeavour; an organisational movement where technology intersects with the levers of people, process, tools and content.

Of these parts, people are arguably the key to successfully embedding KM into an organisation. They are asked to perform outside the perceived constructs of their role, for which they're unlikely to receive plaudits. Such outputs might include profiling content with metadata using clear, unambiguous language so it can be easily found or joining a community of practice and participating in knowledge-sharing sessions (in addition to existing roles and responsibilities).

In whatever form KM activities manifest for the individual, it will involve applying intent to their activities and an understanding of how those activities intersect with other areas of the organisation. So these activities must have tangible benefits for the employee and the organisation.

Monica Danese-Perrin is head of knowledge management at digital business services firm Emergn and was tasked with creating communities of practice at Lloyds Banking Group, as part of a move to an agile working model. Employees were required to upskill as part of the transformation project and, as part of the process, agile coaches were brought in to identify capability gaps.

Danese-Perrin used the hub-and-spoke model to scale and connect capability across the organisation. Parts of this process were to drive new capture processes to improve knowledge findability and these tools were effectively used for knowledge creation, sharing and storage. At least 70,000 employees use the tools Danese-Perrin introduced and this initiative was shortlisted for the Henley Forum Advancing Organisational Change and Development Practice award.

Understanding the objectives of a project from a KM purview can save an organisation significant rectification costs. "Any KM initiative has a commercial consideration, in terms of what it can save or make the organisation, so approaching it with a clear purpose and intention is critical."

Organisational silos can result in money sinkholes with disconnected business functions soliciting 'silver-bullet software' in a vacuum.

Microsoft Viva is marketed as an employee experience platform – its holistic offerings are a beguiling proposition. Viva Topics teases the holy grail of information findability, using AI technology and other dependencies in the Microsoft suite. Layering AI onto a content database that hasn't been organised, classified or governed with life-span management practices won't of itself bring about the desired outcome. Without embedded KM processes, the underlying interdependencies might all too easily be overlooked.

By contrast, software provider ClearPeople has a digital workplace product, Atlas, which leverages the capabilities of SharePoint Syntex (a lesser-known AI-based Microsoft product). The synthesis of these products presupposes an existing taxonomy, metadata, information architecture and governance.

Silos aren't an issue at global law firm Shearman & Sterling. Jon Beaumont, senior knowledge manager, describes the collaborative relationship between CTO and chief knowledge officer which was pivotal to the success of a project to move from a disparate on-premise file-share system to a cloud-based document management system, iManage 10, at the height of lockdown. The system has delivered increased security and centralisation of documents, and has future-proofed search capability initiatives. But it hasn't been implemented entirely without issue, with the occasional inconsistent document profile and metadata-tagging by content owners.

In 2020, technology pivoted to facilitate a raft of business-critical requirements, one of which was remote contract exchange and esignatures. Jenni Tellyn is a KM consultant at 3Kites Consulting, who worked on a project to implement DocuSign. The contract exchange and esignature platform was a key business enabler for the organisation during the pandemic, providing a sustainable and risk-averse approach to contract completion.

While she believes that "KM bridges the gap between technologists and the wider business", Tellyn identifies the critical role which people play in the process of KM delivery. "People often wish to subscribe to the benefits offered by KM but without having actively contributed to them," she observes – a sentiment that is echoed by Beaumont.

There is another red flag that can be tied back to the lever of people and the imperative of providing a clear narrative around the 'why' of KM application, alongside the 'how' of technology. When the case for KM no longer needs to be argued, it will become the connective tissue of the organisation and critical to digital sustainability endeavours through the robust management of software, content and media assets.

The spirit of this outlook is summed up in Danese-Perrin's definition of KM, which transcends its otherwise utilitarian essence: "KM is couture for data. It's made to measure – and good KM should be both intentional and invisible."

COMPANIES ARE FAST LOSING KNOWLEDGE, LIKE NEVER BEFORE...

Nearly

1.2 million

people aged 58 to 75 left the UK workforce during Covid-19

3%

of UK workers changed jobs between April and June 2022

Dunstan Thomas/Office for National Statistics, 2022

INTERVIEW

Mach speeds innovation

Anjali Subburaj, digital commerce chief architect at Mars and Mach Alliance ambassador, talks about her experience of implementing Mach and explores the benefits for digital transformations

Emily Soares

It has been called the future of architecture and a leading group of advocates for it has been dubbed "the coolest tech club in town". No, it's not the metaverse or the next big thing in crypto. Instead, it's something called Mach.

Mach is an acronym (for microservices-based, application programme interface-first, cloud-native software-as-a-service and headless offerings). In short, it is a technology architecture that allows businesses to have complete control over their digital commerce ecosystem.

And according to a 2022 study by Mel Research, 79% of tech leaders are planning to increase their investments in it over the next year and beyond.

"The individual elements of Mach have been around for some time," explains Anjali Subburaj, digital commerce chief architect at Mars and an ambassador for the Mach Alliance. "But combined, they offer a new structured, modular technology architecture principle which is very powerful."

As well as giving businesses control of their digital commerce, Mach provides the flexibility to respond to change quickly and seamlessly, helping them to meet the evolving needs of customers and the wider market. And as Subburaj knows, the benefits of Mach for modern, direct-to-consumer (D2C) brands looking to create premium experiences for their customers can be enormous.

"Mars is looking to have Mach as its future technology architecture," she says, adding that work on a new Mach offering for Mars' flagship brand, M&M, started last year and is due to go live soon.

The process involved taking classic Mach products available from vendors, and combining and augmenting them with Mars's own custom solutions to create a seamless, premium omni-channel solution for D2C business.

"We were struggling with an existing legacy platform that had outlived its life," explains Subburaj.

> **The individual elements of Mach have been around for some time. But combined, they offer a new structured, modular technology architecture principle which is very powerful**

"We needed top-grade solutions for everything and we were looking for something that would give us a competitive edge while helping us to deliver a seamless and personalised experience to our consumers."

Before joining Mars, Subburaj had worked on a D2C omni-channel offering for another business which had involved more traditional, non-Mach solutions. "It was a challenging experience and somewhat frustrating because I had to create three different silos: one for the website, one for mobile and one for point of sale. So I knew the drawbacks of trying to do omni-channel with a traditional set of technologies," she says.

It's a familiar problem. Brands and retailers that market and sell online have relied on legacy software platforms that are inherently inflexible and complex, and that limit innovation, explains Kelly Goetsch, chief strategy officer at Commercetools and chair of the Mach Alliance. "This reliance can make it hard for businesses to adapt quickly to their customers' evolving needs, and it can ultimately leave them vulnerable to decreased customer loyalty and revenue," he warns.

Subburaj adds that the challenge with a company such as Mars was the complexity of the organisation. "It's not a single business," she explains. "Mars has different segments, sub-segments and multiple brands, and we needed to find a solution that's one size fits all."

What drew her to Mach was that it could support "innovations in both a test-and-learn format as well as building scale". That offers huge advantages for a complex organisation in a rapidly evolving digital landscape.

But despite its clear benefits, Subburaj warns chief technology officers (CTOs) not to "just jump on the bandwagon" without having first set out a personalised roadmap that clearly shows how it will work for their organisation. That might require some persistence.

"It's an emerging technology, so tech leaders need to invest in understanding, educating and taking their businesses with them," she says. "I've seen a lot of challenges where technology teams will say, 'Yes, we want Mach', but then the business stakeholders are not getting it. So there is that tension."

Some large legacy organisations are not geared towards agility, she says, "which can slow down the delivery of value, making business leaders lose faith in something they are already nervous about".

During the process with Mars, Subburaj says she worked closely with the Mach Alliance. Described as the "coolest tech club in town" by Forrester analyst Joe Cicman, this not-for-profit industry body advocates for open and best-of-breed enterprise technology ecosystems. It consists of more than 50 vendor members, as well as brand ambassadors from the end-user companies. Set up during the first lockdown of 2020, it aims to help organisations understand how to use and leverage Mach technologies to improve their digital experiences.

Sree Sreedhararaj, CTO of French cosmetics giant Sephora and a Mach Alliance ambassador, says the main benefit he has gained from the alliance has been an educational one. "As a CTO or a technologist, there is much to learn daily from peers and other ambassadors," he says.

Sreedhararaj adds that CTOs and chief information officers (CIOs) have traditionally been focused on infrastructure and the IT helpdesk support and operations. Technology was therefore always seen as a cost centre for businesses. But lately, organisations have come to realise that technology is an integral part of business strategy.

"Technology drives new companies and business models which never existed before," Sreedhararaj explains. "While lots of organisations have started to realise the benefits of technology by looking at their peers and competitors, many chief experience officers are stuck with a traditional mindset. But technology is changing and advancing at a much faster pace," he adds.

Nishant Patel, co-founder of headless content management system Contentstack and a founding member of the Mach Alliance, says the ease of integration – and subsequent flexibility – that application programming interfaces (APIs) offer, and the range of capabilities provided by microservices, will only become more attractive over time.

"The business case for cloud has been proven time and again, and the move towards headless technologies and composable commerce will accelerate it," he adds.

It's a trend that is already visible in some big retailers. David Edwards, head of architecture at fashion retailer River Island, reports that all of his company's technology choices are now made in alignment with Mach principles.

> **It's an emerging technology, so tech leaders need to invest in understanding, educating and taking their businesses with them**

"We started with a small investment and now we're accelerating our strategy to build a customer-focused, modern digital platform underpinned by Mach technology," he says. "This will extend beyond the current implementation surrounding online checkout – and move across channels and capabilities to offer our customers an unrivalled experience that's unified across touchpoints."

Mach enables a faster pace of change at River Island, says Edwards. "The composable nature of a Mach architecture allows us greater flexibility to choose partnerships like Commercetools, Talon.one and Attraqt where it matters, but to choose just good enough partners where it doesn't. It also allows us to easily change in the event that our Mach partners are unable to meet our needs," he explains.

And with commerce ecosystems constantly changing as new trends – such as shoppable video, social media-based selling and premium experiences using augmented reality, virtual reality and the metaverse – emerge, brands need the flexibility to respond quickly to the market.

"Mach frees organisations up to respond to change with greater certainty," says Goetsch. Indeed, elements such as headless technology (which is when the front end, user-facing element of an online store is separated from the back end functionality to enable greater flexibility and customisation) mean they can rapidly build and scale what they need and reduce costs at the same time.

And Mach principles don't apply only in the D2C market. According to Subburaj, these technologies offer lots of exciting opportunities for the B2B market – and for improving employee experience.

"Why should business customers not have a premium experience and speed, just like consumers? Their processes and path to purchase are slightly different, with different complexities, but these customers also want to do their purchases online and they want the same online experience. And the same principles could apply to employee experience, too," she adds.

With many tech leaders now looking to invest in Mach for their forthcoming digital transformations, it's clear that the traditional technology architecture of the past decade might not be sufficient to respond with speed and agility to a fast-paced future environment, particularly if doing so in a cost-effective way remains important.

Olemedia via iStock

Mach explained

Kelly Goetsch, chief strategy officer at Commercetools and chair of the Mach Alliance, explains the technology behind the acronym

M is for microservices
Microservices are small applications that do one thing and do that one thing well. Inventory, pricing and promotions all commonly use microservices. The key is that they can be built, updated and deployed independently. This allows organisations and vendors to be constantly iterating and deploying new functionality, which ultimately leads to more top-line revenue.

A is for API-first
Being API-first means you start by modelling the interface you want and then writing the code to implement it. This means the APIs are a lot more user-friendly than if you had started by writing the code first.

C is for cloud native
Cloud-based multi-tenant SaaS (software as a service) – where a single application is held in the cloud and accessed by many users – means that you're using a well-run service rather than relying on code that you own, manage and run. It's the difference between getting a pizza delivered to your house and having to make one yourself. Businesses want to consume clean services that auto-scale rather than having to rely on inflexible bits of code.

H is for headless
Headless tech is a decoupling of the front end (the bit the user sees) of an ecommerce platform from the back end (where the functionality lies), allowing multiple front ends (heads) to be independently iterated and released, all in parallel. Historically, the "head" (there was only the web until recently but now there are mobile sites and apps, too) was simply embedded into the underlying commerce platform.

INSIGHT

'Our public services need shared, cloud-based utilities'

The public sector needs to learn from – and collaborate with – digitally transformed businesses to overhaul their offering, says Digital Leaders advisory board member, Professor **Mark Thompson**

Q From a technological perspective, what's holding back the UK's public services?

A The UK is entering its toughest economic environment for decades, and citizens are experiencing ever-lower standards of public services. As an academic studying digital business, I believe there's an obvious explanation: public services have accrued a dead weight of duplicate functions and activity over the years. This adds little value and consumes billions that could be spent on more (and better paid) doctors, nurses and teachers and better-funded social care, local services and infrastructure.

In effect, the public sector is being held back by a widespread misunderstanding about what digital technologies can do. A scan through the government's Digital, Data and Technology Profession Capability Framework – available on gov.uk – offers a clue to a seismic secret about our public services. The 'job families' listed are: data, IT operations, product and delivery, quality assurance testing, technical (think: developers), and user-centred design. These focus, variously, on procuring, building, running and assuring a 'shadow' technology industry that embellishes what exists. None offers any leadership or a robust challenge to government-as-usual.

Q Would the cloud and digital business models help?

A Yes – in fact, the solution is radical digital transformation. We need a reappraisal of the role of, and a reorganisation around, the huge capabilities and efficiencies of cloud-based technologies, notably AI/machine learning, process automation, data analytics, the internet of things and blockchain. All well-led private-sector organisations have completed such a transformation or are undergoing one, from the media industry (is the group behind the *Daily Mail* just a newspaper business anymore?) to travel (Ryanair only makes about 70% of its revenues from traditional airfares), banking (how did your bank get inside your smartphone?) and retail (see Amazon's journey from online bookstore). Businesses avoiding this radical rethink risk rising costs, an inability to give customers what they want, and insolvency.

If that sounds familiar, it's because the same logic applies to public services. A base platform of these 'hyper-scale' technologies could eliminate vast quantities of redundant public-sector activity, freeing up lots more public servants to serve the public. Digitally literate organisations relinquish 'invented-here' behaviours and use the cloud to share common data, processes, functions and technologies. In so doing, they start to understand more about their customers' preferences and concerns, continually experimenting and evolving their services to meet these needs. Crucially, these – always painful – transformations involve reorienting around customers, giving them more of what they want, when they want it.

Q Is there an opportunity for the private sector here?

A A digitally transformed public sector would enable a rethink of the technology industry's role in public services. Currently, government uses industry to support a legacy estate of increasingly redundant technology, and to specify, build and maintain bespoke 'new' technology services. These are then duplicated across our schools, housing associations, local authorities, NHS trusts, higher education institutions, police forces and so on.

Over time, digitally transformed, rather than digitally embellished, public services would squeeze out this chaotic and unsustainable public-private circus for a shared, rigorously governed platform of cloud-based utilities, services and associated activities provided as a service by a plethora of private-sector organisations. Public servants would be offered clarity of purpose, larger budgets and improved intelligence to support what they do for us every day. Radical, digitally enabled transformation of our public services is inevitable if we do not want them to start to collapse within the next decade. The question is: just how bad do things have to get before then?

Professor Mark Thompson
Advisory board member
Digital Leaders

EMBRACING AI

There's plenty of talk about the exciting benefits and applications of artificial intelligence, but for the CTOs and IT professionals on the front line, there are still plenty of practical issues to think about first. So, how is the big roll-out going so far?

53%

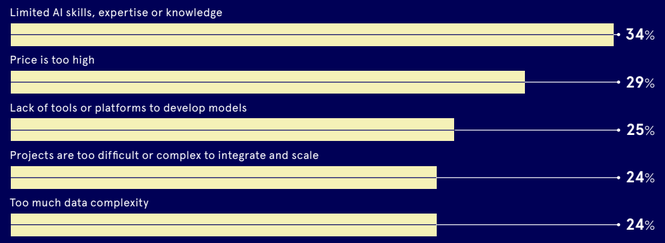
of IT professionals say their company has adopted more AI over the past two years. But just...

28%

of companies have a holistic AI strategy in place

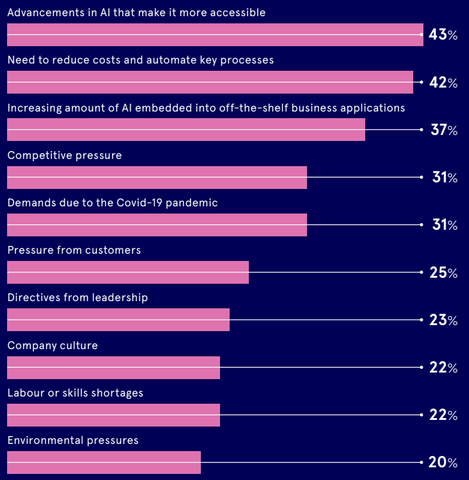
WHAT'S HOLDING BACK AI?

Survey of 7,500 global IT professionals, % of respondents



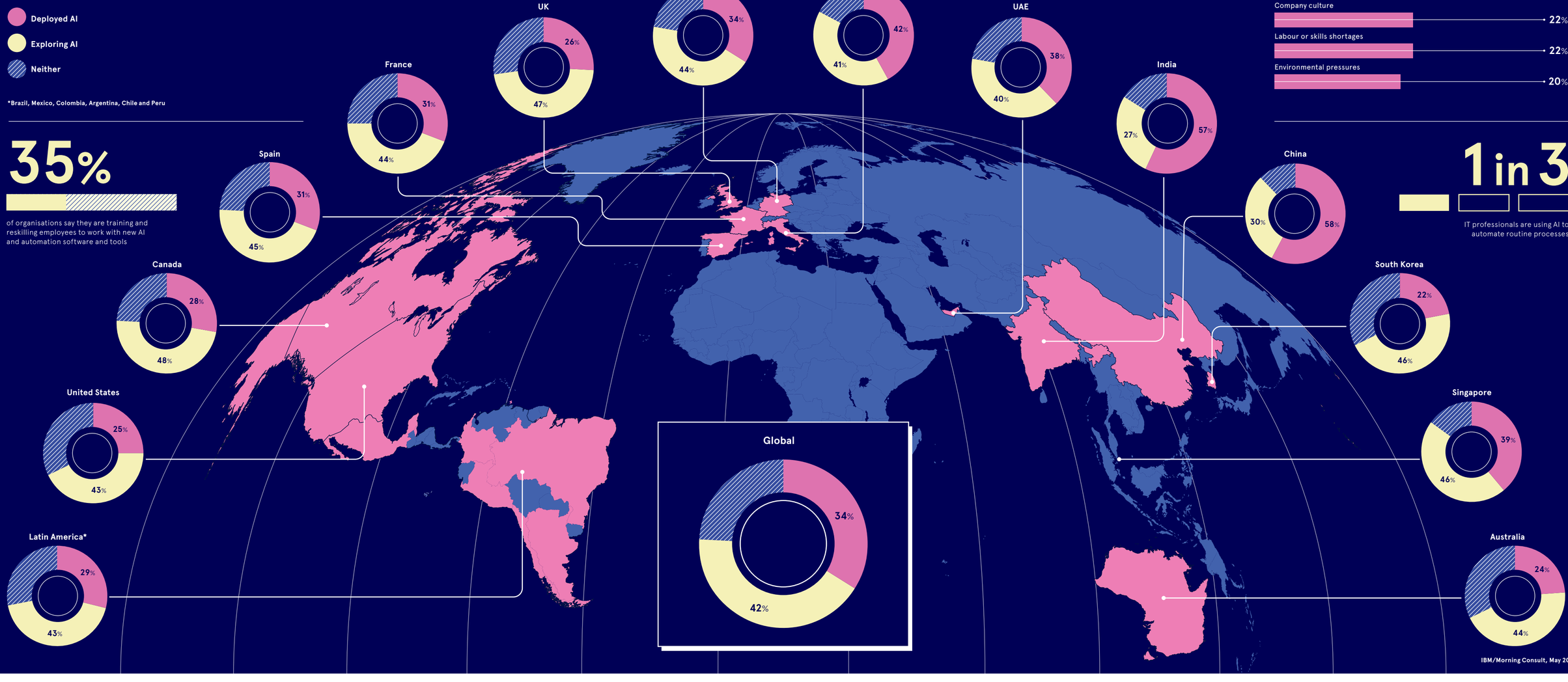
WHAT'S DRIVING AI ADOPTION?

Survey of 7,500 global IT professionals, % of respondents



AI'S GLOBAL REACH

Average AI adoption rates, based on a survey of 500 companies in each jurisdiction



35%

of organisations say they are training and reskilling employees to work with new AI and automation software and tools

1 in 3

IT professionals are using AI to automate routine processes

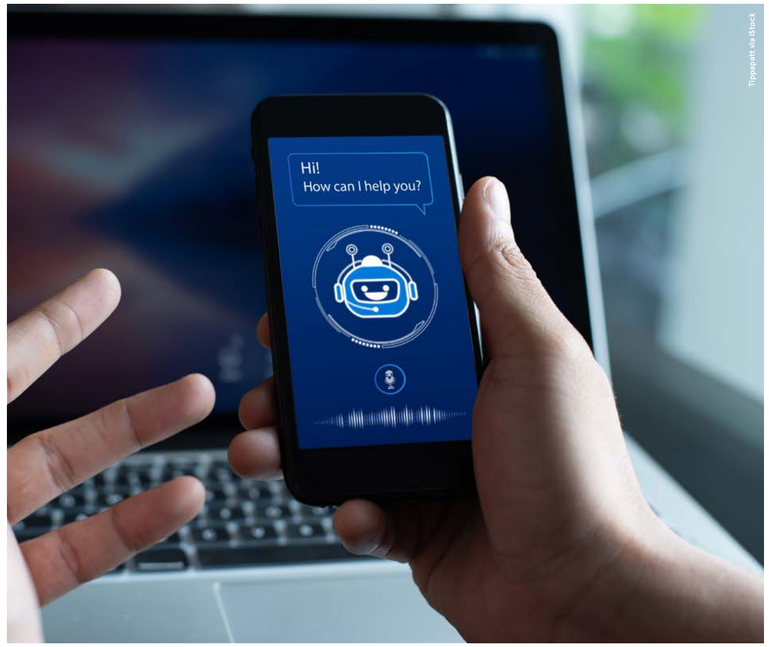
IBM/Morning Consult, May 2022

ARTIFICIAL INTELLIGENCE

Time to try ‘lean’ AI?

Businesses are rushing to build and implement artificial intelligence systems, but might it be cheaper and easier to buy in the right tech and relevant expertise?

Jack Apollo George



Tippapatt via iStock

It’s amazing the sway that two letters can have. Investors’ ears prick up. Rivals fear obliteration. Shareholders smell progress. But for all of the outsized value that a simple mention of AI (artificial intelligence) can bring to the boardroom, there are only a few companies really able to maximise its commercial potential.

This is because applying AI effectively requires a large amount of infrastructure, both cultural and material. For advances in machine learning (ML) and other frontier fields to be truly integrated into a business, there needs to be a considerable quantity of data, a clear process and skilled practitioners to put these to good use. Many businesses, even larger ones, do not have those ingredients to hand. For other, smaller enterprises, there simply isn’t the time or money to create an effective internal AI operation.

As a result, specialist companies, often startups, are offering a leaner, outsourced AI operation as a service. In the process, these specialist companies are expanding the applicability and power of AI in all of our lives. The more that businesses are able to tap into these technologies, the more customers they’ll reach.

“By outsourcing AI to highly specialised tech companies, not only individual companies but also the entire industry can benefit as the AI models can reach some level of generalisation,” says Ramakrishna Nanjundaiah, co-founder of Phantasma Labs, which provides AI-based models for automotive companies and smart factories. “Generalisation is hard to achieve if industries do not share insights on the range of use cases and the intended value expected from the AI,” he explains.

By working across industries, such specialist companies are more likely to make real advances in the field, potentially to the benefit of all. By focusing exclusively on AI tasks, these companies are far better equipped to try new techniques and approaches, and become true experts at applying breakthrough methods to a variety of real-world cases.

This might strike many chief technology officers (CTOs) as anathema to their modus operandi. Aren’t they, after all, the harbingers of innovation? Outsourcing an AI project requires a level of self-awareness and humility, tapping into a risk-averse mentality and admitting that such quests may be beyond an enterprise’s core capabilities. Many businesses cannot justify expensive outlays that result in failure. And as a frontier technology, AI projects are far from guaranteed to succeed.

A deciding factor will often be the maturity of the company’s existing data capture and management systems. The unthinking accumulation of data for data’s sake is insufficient to foster a competent AI operation. The appropriate data has to be captured and then processed, tagged, stored and updated regularly in order for it to be useful.

“Before considering AI adoption, it’s important to know where your data lies,” says Chris Royles, field CTO for Europe, the Middle East and Africa at Cloudera.

“Here, having a robust data management strategy is key. Since algorithms are essential for machine-learning processes, meaningful results can only be achieved by leveraging high-quality data.”

> **Artificial intelligence can infuse your business with the information and agility needed to adapt to market changes and deliver innovative solutions**

Data is important but it’s unlikely that an individual business starting an AI operation from scratch will have all of the necessary data points. Fortunately for many, owning proprietary data and pursuing a big data strategy is far less of a mission-critical moat than it might have been a few years ago, when data was heralded as “the new oil”.

“Data becomes redundant over time,” explains Nanjundaiah. “The Covid crisis has shown us that industries cannot rely on past data alone for preparing for future emergent scenarios. There has to be a different way in which we can prepare industries for black-swan events.”

Techniques such as reinforcement learning are the next natural evolution of AI, he says, “where we can build value-delivering AI models without the need for big data”.

Another factor motivating CTOs to look beyond an internal operation will be cost. AI specialists such as machine-learning engineers are very well paid. Salaries above £100,000 are expected but, unless combined with an effective or well-informed team around said engineer, their talents will often end up frustrated.

Indeed, hiring a couple of experts internally may be insufficient if there is a lack of documentation, agreed-upon frameworks and tacit knowledge already in place. An outsourced team, however, will be better able to tap into a general suite of best practice, experience and specialties as well as being on top of all the important regulatory and AI safety requirements.

Cloudera’s “hybrid data cloud” allows companies to tap into AI- and ML-powered data services, regardless of their own data capabilities. Their advice for CTOs looking to adopt a leaner, outsourced approach to AI is to use the opportunity to explore these new technologies at their own pace – and appreciate the value.

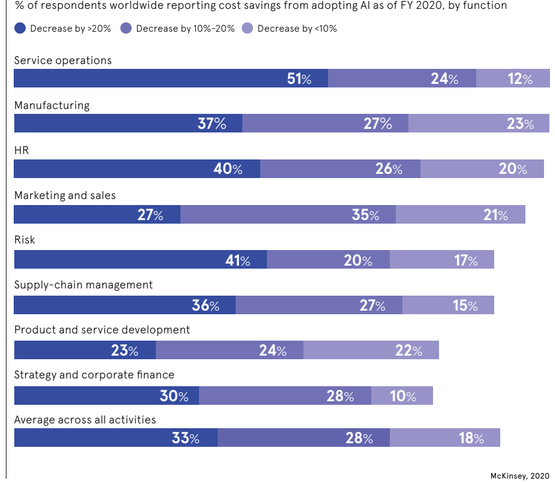
“Artificial intelligence can infuse your business with the information and agility needed to adapt to market changes and deliver innovative solutions,” says Royles.

When outsourcing, he says, it’s wise to start small and implement one use case at a time. “Keep in mind that the sequence you create may inform the use cases that follow. Then you keep building on,” he says.

A key consideration for any CTO facing the question of whether to outsource an AI project is how ready they are internally to cultivate their team and AI expertise. It’s an expensive, resource-heavy task that requires openness to failure and experimentation plus a clear sight of the necessary goals. Outsourcing the first projects might be the most efficient way to learn how they want to integrate AI into the existing technology stack. ●

THE SMART (AND CHEAP) OPTION

% of respondents worldwide reporting cost savings from adopting AI as of FY 2020, by function



McKinsey, 2020

Commercial feature

The growing hunger for consumption-based IT services

Demand for mission-critical IT services bought through subscription is soaring, but Forfusion’s chief technology officer Ian Musgrave warns IT leaders must focus on understanding their strategic needs before identifying products

IS NETWORK-AS-A-SERVICE (NAAS) THE NEXT BIG TREND?

Between now and 2027 we anticipate a significant shift in NaaS adoption across all sectors

15%

of enterprises will adopt on-premises NaaS by 2024, up from less than 1% in 2021

Gartner, 2021

Up to

35%

the compound growth in the NaaS market over the next four to five years

MarketDigits, 2021

The top services required from NaaS providers

Network lifecycle management **48%**

Network resiliency **42%**

Monitoring and troubleshooting to meet service-level agreements **38%**

Report Ocean, 2021

41%

the compound annual growth rate of NaaS adoption through 2027

Report Ocean, 2021

Businesses and organisations no longer need to rely on CAPEX budgets when purchasing and managing mission-critical IT infrastructure. Instead, there is a huge opportunity to save time and money, and mitigate risks by harnessing consumption-based models.

The idea began 20 years ago when Amazon launched AWS, establishing a mindset shift in how enterprises bought technology and applications.

Take email as an example. This once necessitated the employment of a small team just to manage the server infrastructure. The same can now be achieved on a per-user-per-month basis as one internal person works with an external provider that will manage everything at a transparent and forecasted cost.

The same theory extends to all manner of software, as well as to on-premise servers and legacy infrastructure being migrated to the cloud. Control, configuration, compliance and day-to-day operations are provided by a third-party vendor or services partner.

Consumption-based services offer greater predictability for CTOs and simpler financial security for CFOs, alongside agility, flexibility and reduced management. It allows CTOs to spend more time focused on the mission-critical, freeing up budget to spend elsewhere.

The advantages already experienced from consumption-based services are a key factor in why CTOs are attracted to adopting them elsewhere across their network infrastructure. This includes everything from LAN and WAN infrastructure to data centre fabrics, and complex end-to-end security solutions.

As current five- to seven-year programmes of capital investment end, organisations can act differently to deliver the same while avoiding the increasing complexity coming their way.

There are many integration challenges to be worked through. But a trusted partner can guide CTOs through all levels of migration and implementation, while allaying any fears.

However, to do this successfully, a clear strategy must already be in place. The primary focus must be to develop a roadmap founded on strategic imperatives. The answer is not simply to dive into more procurement for another investment cycle and then write this off as a capital expense, as has traditionally been the case.

Tacking the strategic imperatives

CTOs can safely, securely and effectively consume IT infrastructure in a way that’s fit for the future without owning all, or any, of it. Organisations can invest today in the technology of tomorrow without having to pay upfront.

But one major risk must be tackled first. Putting too great a focus on the ‘what’ – the products – rather than the ‘why’ – the strategic imperatives – can quickly lead to failure. A roadmap helps here because a company must fully understand where it is, before it can know where it is going.

Whatever the sector, every company must have a clear view of its future state. To achieve this takes time and a deep analysis of the current state, identifying all the gaps. This creates a firm blueprint that will identify all the demands and challenges in the years ahead.

Having this as the foundation upon which to make decisions means organisations can be more creative about the way they choose to consume services. Knowing the strategic imperatives is also critical for CTOs when approaching CFOs and CEOs for their buy-in.

Today’s core business challenges faced by the C-suite – efficiency, automation, agility and sustainability – are perfectly met by consumption-based services. Boardrooms and leadership teams do not need to fully grasp the technology involved, but they do need to understand the investment opportunity for the bottom line and productivity. Being able to use OPEX rather than CAPEX budgets is a major positive for them. But whether the need is to migrate 10% of an estate from perpetual to subscription-based licences, plug resourcing gaps or free up capital to consume the latest products and services, a trusted partner can help.

Their work will include delivering operational consistency and owning the risks as CTOs continue delivering mission-critical projects on time. This change in approach to product and service delivery through consumption requires a different type of experienced integrator, one who can effectively source the right products and services.

They should also be capable of plugging any resourcing gaps along the way through staff augmentation services. Resourcing can be consumption-based by finding the right skills at the right time. This is becoming harder and harder during the current battle for talent and the best integrators can deliver this expertise at a fraction of the cost of a large annual salary to deliver on a specific project.

> **Consumption-based services offer greater agility, flexibility and predictability for CTOs and simpler financial security for CFOs**

Navigating the roadmap

Whether in the public or private sector, CTOs will always seek to minimise risks and improve efficiencies. Consumption-based services are ideal for managing peaks and troughs, alongside complex moving parts.

Any trusted partner navigating this with you must fully understand the scope of all markets to help clients strategise. They will have significant experience in developing cost models to support transitions to the cloud or to myriad consumption models.

This is where Forfusion brings value. Our clients are mid-sized and large enterprises in the private sector, alongside health, local and national government, and the broader public sector. We can also utilise our security-cleared personnel where required.

Our significant expertise comes from developing and delivering consumption-based services for our clients’ mission-critical infrastructure, understanding that CTOs will fear connectivity problems and availability issues. For the NHS Trusts we work with, this can literally be a matter of life and death when there are machines keeping patients alive.

It is a responsibility we take extremely seriously. We will assess and advise, and together we will design, integrate and operate across one or more technology pillars. Whether the requirement is licence consolidation, secure networking infrastructure, cloud migration, or circuit provision, we deliver consumption-based services precisely the way you want them.

Our roadmap and strategy definition ensures successful realignment and transition by focusing on long-term return goals. These might include competitive advantage, financial gain or making a positive impact on sustainability.

Forfusion has years of experience assessing existing environments and aligning them to a future state. The scale of the digital transformation required in the next three to five years can be daunting for a CTO, but we are vastly experienced at handling the most complicated and complex scenarios.

Consumption is a model that is moving aggressively, far quicker than many technologists had anticipated. When approaching this, your organisation should never just be another number for a vendor. The risk of failure is too great. For this type of implementation to work, the notion of consumption must be realised and achieved via a robust initial strategy.

The path to consumption rather than traditional procurement is unavoidable. Now is the time for CTOs to identify their challenges, set baselines and move their organisations forward by embracing the advantages and benefits that consumption-based services can offer.

Talk to our team to find out more:
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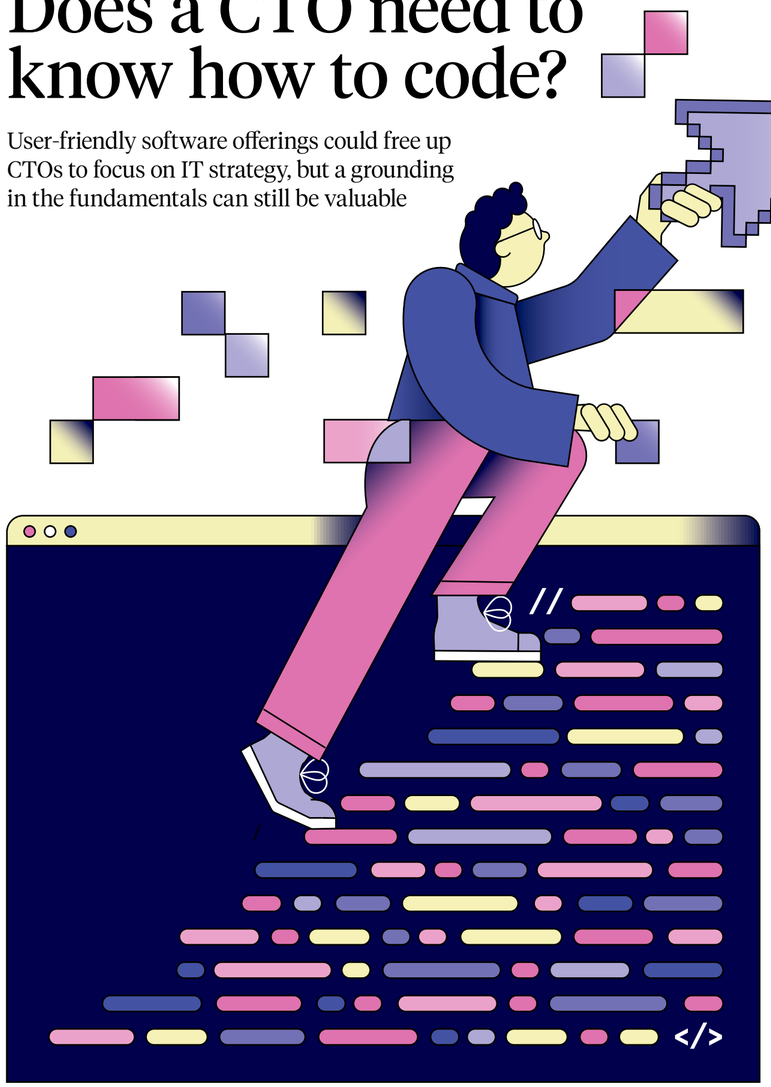
0191 500 9100
www.forfusion.com/services/assess

forfusion

SKILLS

Does a CTO need to know how to code?

User-friendly software offerings could free up CTOs to focus on IT strategy, but a grounding in the fundamentals can still be valuable



Adrian Bridgwater

Times have changed. Until relatively recently, every decent CTO, CIO or CISO (insert C-suite tech role of your choice) would have 'done the knowledge' and learned to hard code at some form of college.

Understanding the rudimentary principles and governing precepts that denote the core mathematical models, systems and processes that make software engineering what it is, was always regarded as bread and butter for any technology manager. But that was then, and this is now.

Today we live in a world where so-called low-code and no-code platforms work alongside software accelerators and AI-fuelled automation tools that can take much of the repetitive grunt work out of software systems development.

We now also enjoy guidance from new cultural approaches such as DevOps (a portmanteau joining developers and operations staff), creating more harmonious workflows. It's worth asking whether the CTO of tomorrow really needs to know their JavaScript from their Java-roast caramel latte.

In the real world, it's mainly those CTOs at startups and smaller operations who still spend any significant amount of time coding. In many cases, the venture itself is their brainchild, so it's natural for them to still be getting their hands dirty with the product or IT service.

"As an organisation grows there is often a more identifiable difference between production-quality code which is good enough to run a business on reliably, versus one that is perhaps more experimental or is at prototype-level," says Priyanka Sharma, executive director at the Cloud Native Computing Foundation.

"A CTO's role changes at that point from a workflow where they are coding themselves, to a new position where they are running an engineering organisation at scale," Sharma explains. "Throughout this progression, understanding the software development process and having empathy for its nuances and challenges is essential to a CTO's success."

From her extensive experience of working with enterprise platform companies – many of which have experienced extremely rapid periods of adoption and growth – Sharma says that a CTO who is not able to at least be 'walked through' code by an engineer may risk losing credibility in the longer term.

"What all this means is that, regardless of a company's stage of evolution or growth, the CTO must have a technical background. But, this doesn't mean they need to come from a conventional computer science education. Some of the best technologists in the cloud-native world are self-taught, and some even come from classics and art backgrounds. Anyone can learn to be a technologist today," she says.

Technology's continual evolution means that CTOs must keep more than just a hand in. For example, one of this year's hottest IT industry trends is Infrastructure-as-Code, the move to provide lower system IT resources as software-defined cloud services. A CTO would be well advised to keep up with the engineering precepts that underpin highly technical concepts such as abstracted load-balancer functions and all the associated platform mechanics.

At the very least, this awareness could make lunchtime cafeteria discussions less painful. At best, it means the business can steer its IT function with a captain who knows where the gauges are in the engine room. The CTO may not always know how to create the right fuel mixture, but they will know which furnace is doing what.

Of course, there are counterarguments. Many think the CTO's role should evolve to become a kind of overseeing evangelist for best practice and progressive work methodologies. In a world where software engineering is increasingly pre-packaged, some say the modern CTO is no longer a fingers-on-keyboard job and they should resign themselves to being strategic architects not stonemasons.

> **Being a CTO is hard. The role demands rock-solid technology skills alongside strategy and people skills. That's a lot to fit in one head**

"Being a CTO is hard. The role demands rock-solid technology skills alongside strategy and people skills," says Dr Holly Cummins, senior principal software engineer at cloud services provider Red Hat. "That's a lot to fit in one head, so something has to get pushed out. Usually what goes is a focus on low-level details. Code is increasingly one of those details."

Cummins says that while the CTO may not be writing or reviewing actual lines of code these days, they should be asking higher-level questions that focus not just on the quality of the code and work, but also of the team behind it.

For example, how confident are we that this works? How do we test it? How much can we automate? How long does it take us to get from a feature request to production? What are the trade-offs in this solution? Are engineers working in our codebase happy and energised? How does our stack affect our ability to recruit talent?

"Some of an organisation's code will be artisanal and important, but other elements will be commoditised and generated from AI coding tools like GitHub's CoPilot or copied and pasted from knowledge-sharing platforms like StackOverflow," says Cummins. "The key to knowing whether code should be reviewed at any level by a CTO is asking the right questions first."

Of course, the shift to cloud and automation affects how a swathe of modern software application development is carried out today. We live in a world where software programmers use an increasing amount of automation and code acceleration technologies to perform their jobs faster. There is a direct implication for the C-suite.

"In a very real sense, the role of the CTO in so many modern application deployment environments is moving from a position of raw materials maker and creator to one of intelligent orchestrator," says Prakash Vyas, head of portfolio marketing at modern enterprise application platform company OutSystems.

As we enter an era with software tools designed to make tasks simpler, faster and more accurate, Vyas says CTOs need to look at the big picture. This must ensure the software platforms their business uses offer the power to personalise, modify and extend a given set of enterprise applications based on what can be significantly disruptive forces, as we are all now aware.

"Does that mean CTOs need to just manage and orchestrate and never code again? Even from my point of view as a low-code purist, I would say generally no," says Vyas. "We don't want CTOs or newbie programmers having to do all the heavy-lifting tasks if an application or enterprise IT service needs some serious refactoring and rebuilding, but we do need all stakeholders in the tech function to know where the spark plugs go."

So does the modern CTO still need to know how to code? The answer appears to be yes, but they probably shouldn't be head down at the keyboard leading the code creation process on the first day of a project.

Nobody wants an over-seasoned football player on the pitch when they really should be a member of the coaching and management staff by now. It's the same for CTOs. They need to know where the goals are, how to build team formation and when to send the substitutes on. They should even know how to kick the ball and how to deal with an unruly tackle. Just don't ever let them take a penalty.

> **The CTO must have a technical background. But, this does not mean they need to come from a conventional computer science education**

BY 2024...

65%

of all application development activity will be low-code

70%

of new in-house applications used by businesses will be low- or no-code

75%

of large businesses will use at least four low-code development tools

Gartner, 2021

Commercial feature

Q&A

In a world of change, CTOs step into the driver's seat

CTOs are now expected to enable business change, but doing so successfully requires the right balance between resilience and agility, says **Jakub Lamik**, CEO of Redgate Software

Q How has the role of the CTO evolved in recent years?

A Typically, the role of the CTO is to use technology to generate value for a company by following an established roadmap in a fairly predictable environment. But as organisations have increasingly recognised the importance of technology in enabling and facilitating change, the role has been elevated to one that is critical to how they do business. In turn, that has changed what is expected of CTOs, who need to be much more aware of what's happening in the broader economy and how technology can facilitate change in response to these market changes. Right now, for example, we've got a lot of supply chain disruption, inflationary concerns in many markets and skills shortages right across the board. CTOs need to navigate their way through the problems their own businesses are facing while also looking ahead to where the next problem will come from.

Q What about the CTO's relationship with risk – has that changed too?

A Risk has moved to the top of the list for every CTO, and it's evolved along with the rise in cyber attacks causing the spread of malware, various data breaches affecting millions of users, and companies being fined huge sums by data authorities for the mishandling of customer data. As a result, many CTOs are now paying a lot more attention to data privacy and protection concerns by, for example, restricting access to production databases and ensuring that copies of databases used in development and testing are sanitised of sensitive data. Not just because of the threat of fines but also the reputational damage from a breach, which can often cost even more in the long term.

Q How can CTOs manage risk while also embracing and even leading change?

A The first step is to standardise and streamline software development workflows, removing laborious manual processes that slow teams down and automating processes whenever possible. That provides the resilience you're looking for. The second step is to be prepared to fail fast, and fail quickly, by releasing small changes, more often, and seeking customer feedback constantly. That way, you can change course when markets and technologies change. When you can do that without missing a step, you are finally a business with agility.

Q What sets the best-performing CTOs apart from the crowd?

A CTOs still need a vision to develop and implement technology roadmaps. They still need to ensure projects and systems are delivered on time and in scope. And they still need to manage budgets that are often constrained. But what really defines a great CTO is the ability to balance resilience and agility, so that when change inevitably comes they can lead through it confidently and successfully. I'm not just talking about the change that comes from unforeseen events. Even before the pandemic, the business landscape was defined by rapid change, mainly due to emerging technologies. CTOs must not only keep an eye on these shifts but be able to recognise if and when they can deliver a competitive advantage.

Q What role is Database DevOps playing in helping CTOs fulfil their new role?

A DevOps, and the agile software development practices that go alongside it, powers both resilience, agility and efficiencies. According to the Accelerate State of DevOps report, elite DevOps performers implement software changes in less than one hour compared to nearly a day among poor performers and deploy 973 times more frequently. Their change failure rate is three times lower, and when failures do happen, they recover some 6,570 times faster. We help companies apply the same principles of DevOps and agile software development practices to their database development to achieve these tangible business benefits, while also keeping their data safe. CTOs must now move beyond roadmaps by developing a vision and strategy to enable business change and be more efficient, in order to drive innovation and manage risk, and Database DevOps is key.

> **Propelled by economic uncertainty and a talent crunch, CTOs are turning to outsourcing, yet this approach is only effective with the right partner**

For more information, visit red-gate.com

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> **Quantum computing has the potential to be, if not winner-takes-all, a winner-takes-most kind of technology**

INNOVATION

The quantum era is coming. Are you ready for it?

Quantum computing promises to unlock an unprecedented computational power, giving businesses and industry leaders a chance to explore the limits of their own ingenuity

Natasha Serafimovska

Even though quantum computing is in its nascent phase, the promise of the technology remains undisputed: a problem that takes the most powerful classical computer today hundreds of thousands of years to solve, a universal, fault-tolerant quantum computer would be able to solve within a matter of hours or days.

But there still needs to be a big leap in science and engineering before we can harness the quantum advantage – the inflection point at which quantum computers can solve problems that classical computers cannot. While this advantage has been proven in a research setting, industry applications still have some way to go. There are several reasons for that. There is a lot of work to be done on the quality of quantum bits or 'qubits' themselves. Their very nature makes them rather fragile and susceptible to external interference. Currently, it takes 10,000 qubits to stabilise and use a single qubit for computational purposes. Then there is the issue of scalability. To see an advantage, we would need a quantum computer with at least 500 to 1,000 qubits, but we're yet to reach this milestone.

Why, then, are we talking about quantum computing today? And what are the repercussions, if any, both for CTOs and other industry leaders who might still be sitting on the fence about it?

While major efforts are underway by governments and quantum technology providers to achieve a quantum advantage in an industrial setting, experts also see a great push by industry end-users to understand the technology and steer its evolution.

This is down to several factors. A breakthrough can happen at any time and several of them have already occurred ahead of schedule. Another element that adds urgency to the issue is simply the limited resources both in talent and quantum machines. Christophe Jurczak, managing partner at the venture capital fund Quantonation, believes that a squeeze in demand is inevitable. "Now's the right time to look at the technology before quantum advantage is proven. The challenge here is that the day we identify one or several use cases that are worth running on quantum computers, there won't be enough machines," he comments.

He says that today there are no more than 100 machines globally and those who have established relationships with vendors will benefit first. Everyone else would have to wait. This wait, thinks Matt Langione, a partner at Boston Consulting Group, can have existential repercussions for businesses. "The opportunity cost for not investing in quantum could be existential. Imagine a pharma company that can search the entire relevant span of chemical space. With a quantum computer, once it comes online, they could simply discover all sorts of drugs, patent them and effectively corner the market, clearing the field of competitors," he explains. "Quantum computing has the potential to be, if not winner-takes-all, a winner-takes-most kind of technology."

Jurczak, who also has a PhD in quantum physics, explains that despite the massive potential of the technology, it would be naive to think that quantum computers would be the panacea to all our computational problems. Instead, executives would benefit from keeping an open mind and seeing how the technology works in synergy with other approaches for best results.

Andrew Foreman, the former CTO for the US Army Europe and Africa, echoes this, having looked at quantum computing right before his retirement last year. He has reflected on how it may work alongside other technologies, like AI and machine learning. "As a CTO, when I look at problem-solving and specifically at emerging technologies, I'm looking at what they can produce in the five- to 10-year mark, not in the near term," he comments. To look beyond the hype, he emphasises the need to talk to different stakeholders both in industry and academia.

"You can't just go to a single source and ask where we are going to be in five years because they're going to tell you what suits them. When I look at emerging technologies, I reach out to about five or six different companies and look for where these overlaps come together," he says.

The final step is to rally all your stakeholders behind the idea. For this, you need to lay out a phased plan that will clearly demonstrate the business benefits at different milestones.

Langione reckons that we'd be able to prove the quantum advantage in an industrial setting sometime between 2023 and 2025 which can produce around $5bn (£4.4bn) in value for end users. Between 2025 and 2030, the industry would look at scaling the volume of qubits, which is expected to produce $20bn to $50bn in added value. Once we crack error correction, which Google estimates will happen by the end of this decade, we can unlock exponential gains in the realm of hundreds of billions of dollars.

Both Jurczak and Langione see finance as the industry which stands to benefit first, although Jurczak also sees great potential in chemistry especially when it comes to drug and material design. Langione, on the other hand, sees automotive and aerospace as the runner-up industries followed by oil and gas and energy. He says that any business that faces a large sparse matrix problem can capitalise on advances in quantum.

The world is data hungry, so much so that classical computers are coming to a standstill in their capacity to process it. Quantum computing is offering a much-needed helping hand, but the technology needs time to mature.

That said, anyone who isn't looking at the technology today risks being left behind tomorrow. Time estimates are a rough guide when we are in such uncharted territories. Here, playing the waiting game can mean playing the losing game. Whether you're looking to gain a competitive advantage or simply protect your IT infrastructure from future encryption vulnerabilities, experts agree that now is the time to look at quantum.

THE MOST POWERFUL QUANTUM DEVICES (SO FAR)

In 'qubits' (a quantum bit is a basic unit of quantum information)

IBM's Eagle processor

127 QUBITS

The University of Science and Technology of China's Zuchongzhi processor

60 QUBITS

Google's Sycamore processor

54 QUBITS

New Scientist, 2022

Commercial feature

How to build trusted relationships through digital engagement

Technology is evolving faster than ever, but a blend of art and science – as well as great online and offline interactions – can help serve consumers well, according to our expert panel

> **The most important element is a human-centric approach**

Roundtable attendees

EA Ed Alford, Chief technology officer, New Look

FH Faisal Hussain, Chief technology officer and chief digital officer, Metro Bank

LJ Leigh Jones, Senior business consultant (EMEA), Twilio

DK Daniel Kornitzer, Chief business development officer, Paysafe Group

Q Given the pandemic and all that has happened over the past couple of years, why is it so important to engage customers digitally?

LJ As a society, and as organisations, we've gone through a turbulent time over the last few years. So, the landscape has changed. Organisations have moved an awful lot faster on their digital strategy... now, we're suddenly seeing them taking a step back, looking at their infrastructure and asking 'how are customers engaging with us?'

DK Digital engagement is important because the way consumers interact with merchants, with banks, with fintechs, has radically changed. The question is, 'how do we elicit consumer loyalty when we only see them once a quarter?' The answer is to create consumer loyalty by delivering value, solving a problem for the consumer and giving them back time. Customers are technology-agnostic – they only care about the benefits.

Q How can you ensure you're engaging customers as effectively through online channels as you do via traditional channels?

FH We call it 'bricks and clicks,' in terms of how we balance the two, because everybody knows that great customer service on the high street is face to face and it is about trust. For us, the hardest part is to offer a digital capability, but try and retain the high street customer service.

EA To be the best omnichannel retailer, I think you've got to build the best digital customer experience. When I engage with anybody who's buying our product, the thing they're always saying is: make it easier. I would like to create the same experience for our customers if they go into our stores as when they're online and in their own house. We're testing fit analytics to allow customers to effectively create a [digital] changing room in their house.

Q How does digital engagement impact revenue and customer retention?

EA People want to be part of your purpose and actually enjoy shopping with you, and that helps with lifetime value. The thing we're doing next is to try and get our designers into the metaverse and start talking to customers at the beginning of the design process, so that we can use that as an engagement platform at that stage. So, by the time it gets to [the] autumn-winter [fashion season]... customers know what we're bringing out and have been part of it.

FH For us, the relationship is that we could be part of key life moments for people. There's a big difference between someone coming in for an overdraft, versus getting their first mortgage. Whether digital can do that completely on its own is one of the puzzles I've got to solve, technology-wise.

Q According to Twilio research, 95% of companies say they are transparent about how they use data, but only 62% of customers agree. Why the disconnect?

LJ [We also found that only] 52% of customers feel somewhat or very high trust with the companies they engage with, so that's incredibly low. We found that [organisations] are not serving them personally. Fundamentally, human interactions and what consumers expect have not changed for hundreds of years. What has changed is the manner in which we're engaging with them. Digital offers so many new opportunities for engagement, but that needs to be personal to have that key moment.

DK As technology providers, it behoves us to reassure consumers. There are examples where trust is a real game changer, [like] cashier-less stores such as Amazon Go. Say I picked [up] two chocolate bars in the store, but my bill comes in and shows three chocolate bars... they make it easy to just swipe on that item and say I'm challenging this. It's important to make that user experience extremely pleasant and seamless.

Q How can businesses build trust, particularly around data, through digital communication?

FH The more digital we become, the more automated we become, the more in-cloud we become, we're one step removed from where [customers'] data is sitting. So, I'd like to see something more, probably on the technology agenda, to be able to talk about the corporate responsibility [of keeping data safe].

LJ It's a personal contract as well between the consumer and the organisation. So, I may be more open to sharing more of my information with an organisation that I feel is trusted, but also delivers on that personalisation. So not just popping my name at the top of an email, but really understanding me as a person.

DK If you build the world's best weapons, you don't have some students operating them, you need personnel that knows how to [use] them, and it's the same with technology; you need pros.

Q Personalisation can provide great digital engagement, but companies often think they're doing it better than they are. How can they get it right?

DK Consumers used to have a very special relationship with mom-and-pop stores where you knew the owner. And with the rise of ecommerce giants, we've gained economies of scale, but we've lost that touch. AI has the potential to inject that level of personalisation, but the question is, 'how do we achieve that without being intrusive?' We need to focus on consumer preference and relevance.

EA It's not just a case of giving the AI on the data and then it auto generates [a communication], there are actually humans at the end of it, who sit down and talk through that customer experience. We add the art and the science before we then push things out.

FH We've got to be relevant, otherwise we'd become annoying as organisations. And then there is the human overlay [to say], we are thinking about you. And then it is a conscious decision to market this to you at this point, because one: we think it's relevant, and two: we think it's useful for you.

Q What are your hopes for the future of digital engagement?

LJ The most important element is a human-centric approach. [For example,] we have our contact centre agents, they're doing a terrific job [and it's] incredibly challenging with the amount of people that are available at the moment. And we need to make sure that we serve them well, so they can serve our customers.

FH Technology is evolving really, really fast. It's getting evermore clever, evermore complex. So, we have a responsibility to keep serving the customers well. I would like to see more forums where technologists get to discuss the responsibilities that they're now growing into.

EA I want to build cool, fun experiences for our customers, and my hope for digital is that the feedback we get actually gets the customers and the organisation closer, so that you can always be responsive.

52%

of customers feel somewhat or very high trust for the brands they purchased or used in 2021

Deloitte and Twilio, 2021

For more information please visit twilio.com

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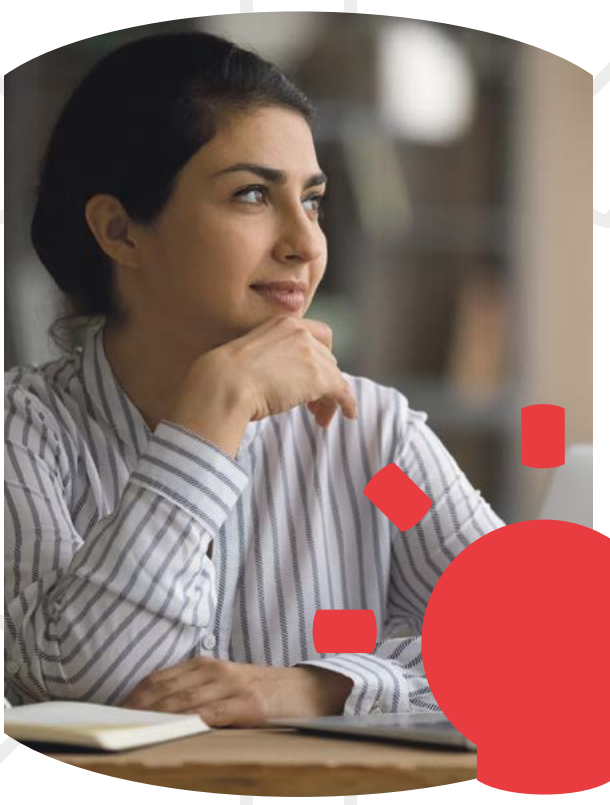

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