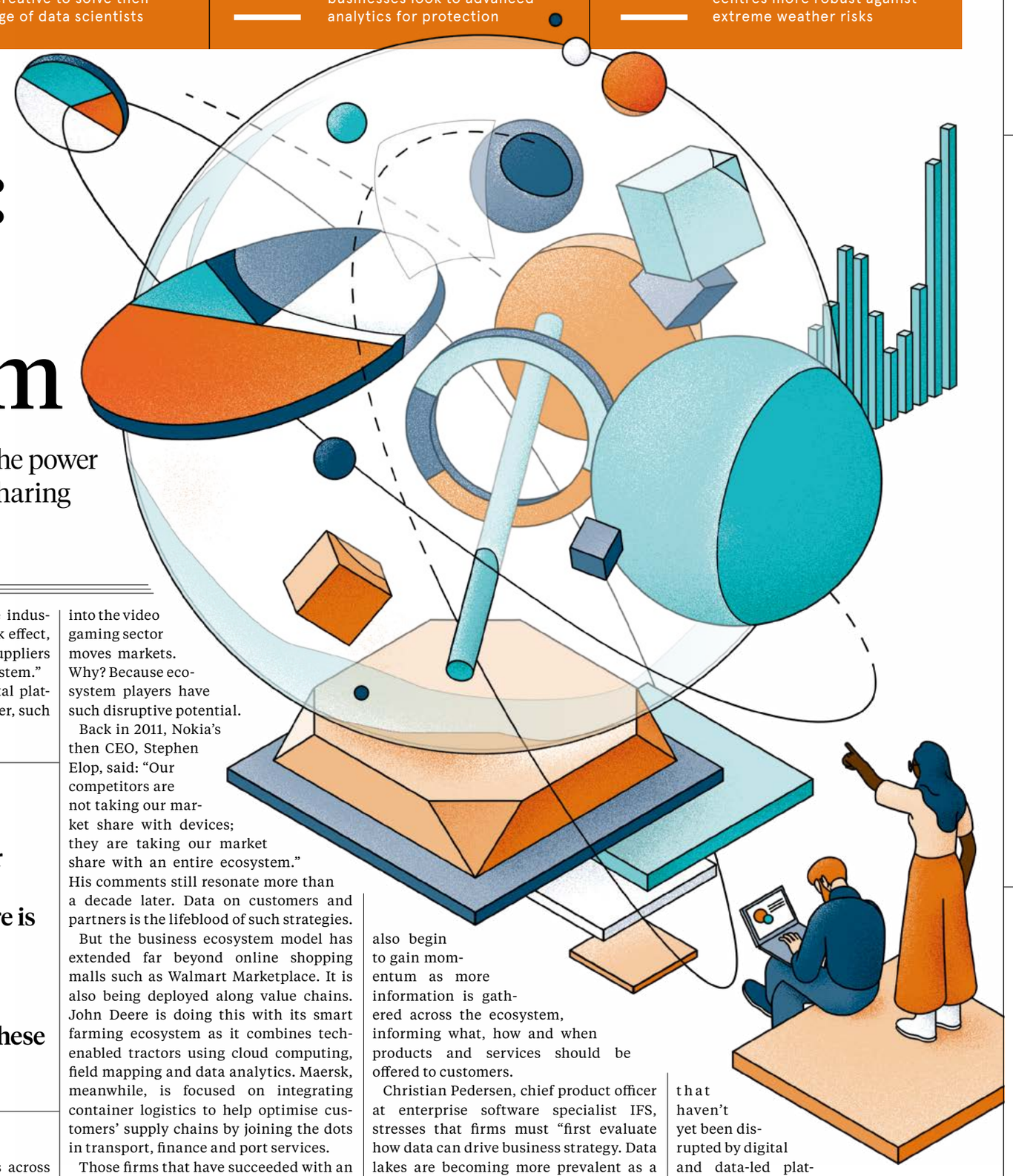
FUTURE OF DATA



DATA CULTURE

Only connect: the rise of the data ecosystem

A wide range of companies are benefiting from the power of multi-partner collaborations based on data-sharing

Nick Easen

The natural world is a great inspiration for business. Ecosystems, where many species combine to produce a thriving entity, are imitated in the corporate world. The whole range of goods and services on which humans depend is delivered by dynamic groups of businesses working in harmony. The DNA that underpins all this activity is data.

Data-led business ecosystems, in which a single source of digital information empowers independent economic players to offer services that customers value, are thriving. Data-sharing collaborations of this type have become a source of competitive advantage – and it's not only online marketplaces that are flourishing as a result of them.

More than half of the world's biggest companies engaged seriously in ecosystem business models, according to research by the Boston Consulting Group's think-tank, the BCG Henderson Institute. Brands ranging from Walmart and Maersk to John Deere and Grab are rolling out ecosystem models that involve a network, linked by flows of information, services and money, where the whole functions better than the sum of its parts.

Advances in "digital platforms, connectivity and data have fuelled the dramatic rise of such ecosystems that we have seen over the past few years", reports Martin Reeves, chairman of the BCG Henderson Institute. "Successful ecosystems can provide access to new capabilities, scale up rapidly, be very adaptive, enjoy high asset productivity and transform entire industries. They also exploit the network effect, whereby the value to users and suppliers increases with the size of the ecosystem."

That's because data-fuelled digital platforms can offer more to the customer, such as personalised recommendations across a broader product range – and at a lower cost. This has hugely expanded what's on offer, breaking the trade-off between complexity and reach.

> **A key area of focus for business ecosystems is explainability. There is a perceived difficulty in taking complex problems concerning data and explaining these to other stakeholders**

When Chubb offers embedded insurance via the Grab "superapp", the big traditional players shudder, while Netflix's venture into the video gaming sector moves markets. Why? Because ecosystem players have such disruptive potential.

Back in 2011, Nokia's then CEO, Stephen Elop, said: "Our competitors are not taking our market share with devices; they are taking our market share with an entire ecosystem." His comments still resonate more than a decade later. Data on customers and partners is the lifeblood of such strategies.

But the business ecosystem model has extended far beyond online shopping malls such as Walmart Marketplace. It is also being deployed along value chains. John Deere is doing this with its smart farming ecosystem as it combines tech-enabled tractors using cloud computing, field mapping and data analytics. Maersk, meanwhile, is focused on integrating container logistics to help optimise customers' supply chains by joining the dots in transport, finance and port services.

Those firms that have succeeded with an ecosystem model started by rolling out a common data and digital platform. This is the backbone, enabling other players to connect and work together using a single source for customers and supply chains. This also enables synergies between businesses to develop. So-called data flywheels also begin to gain momentum as more information is gathered across the ecosystem, informing what, how and when products and services should be offered to customers.

Christian Pedersen, chief product officer at enterprise software specialist IFS, stresses that firms must "first evaluate how data can drive business strategy. Data lakes are becoming more prevalent as a means of storage, largely because it's easy to run analytics on these lakes and then use the output to feed an ecosystem of business tools that take advantage of it."

And that's where data-led business ecosystems are different from mere digital platforms. Ecosystems depend on shared data to inform stakeholders' strategic and tactical decision-making. Their success also largely depends on how humans interpret the material and act on it. The easier it is to digest, the better.

"A key area of focus for business ecosystems is explainability," Pedersen says. "There is a perceived difficulty in taking complex problems concerning data and explaining these to stakeholders. But we are seeing the emergence of techniques such as explainable AI, which is providing more information to decision-makers far more quickly."

But becoming a business ecosystem player empowered by data is far from straightforward. The BCG Henderson Institute believes that only 15% of the ecosystems it has studied can be sustained in the long run. It's a jungle out there, with a huge rate of attrition. Dominant market incumbents are proving less successful at it than large tech or startup players.

Reeves says that one of the most common mistakes a firm can make is to "automatically assume that it has the right to be the orchestrator of an ecosystem when most do not. Building one incurs costs and risks. Industries with significant customer friction, such as high intermediary costs, delays and mismatches, and those markets that haven't yet been disrupted by digital and data-led platforms provide many such opportunities. Lots of these have already played out in the B2C space, but the potential of B2B and the public sector remains largely untapped."

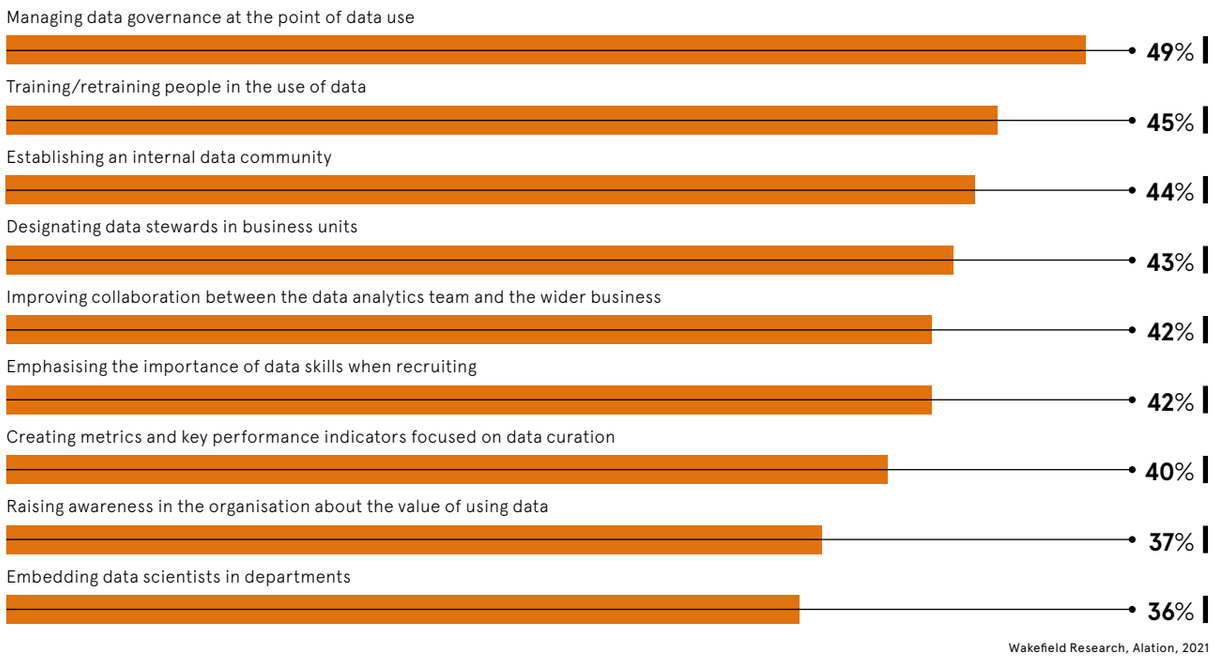
Yet overly complex data infrastructures, siloed data, legacy systems and a lack of real-time information plague many sectors, making ecosystem models less viable. Newer technologies, such as smart data fabrics, can help to overcome this. These enable organisations to capitalise on data lakes, building a layer of command and control on top as well as stitching together distributed information. Bringing in the right talent can also help in this respect.

"Against a backdrop of uncertainty, businesses across all sectors are looking to their data to gain a competitive edge," notes Chris Norton, managing director at IT consultancy InterSystems in the UK and Ireland. "Organisations are also often unaware of just how much value can be added to their innovation initiatives through the inclusion of data specialists."

The ecosystem business model presents new opportunities in numerous sectors, particularly specialist niche markets. Yet finding such opportunities, as Reeves notes, may require imagination and counterfactual thinking – a process that data can also inform. The concept of business ecosystems is not new. What has changed is the data empowerment element and the understanding that, with the right systems in place, ecosystems can be scaled up quickly and efficiently. It's what's making them such an exciting growth prospect.

TOP INITIATIVES TO FOSTER A DATA CULTURE AMONG LARGE COMPANIES IN NORTHERN EUROPE AND THE US

Percentage of senior executives in the data analytics function citing the following as measures their firms were using



Wakefield Research, Alation, 2021

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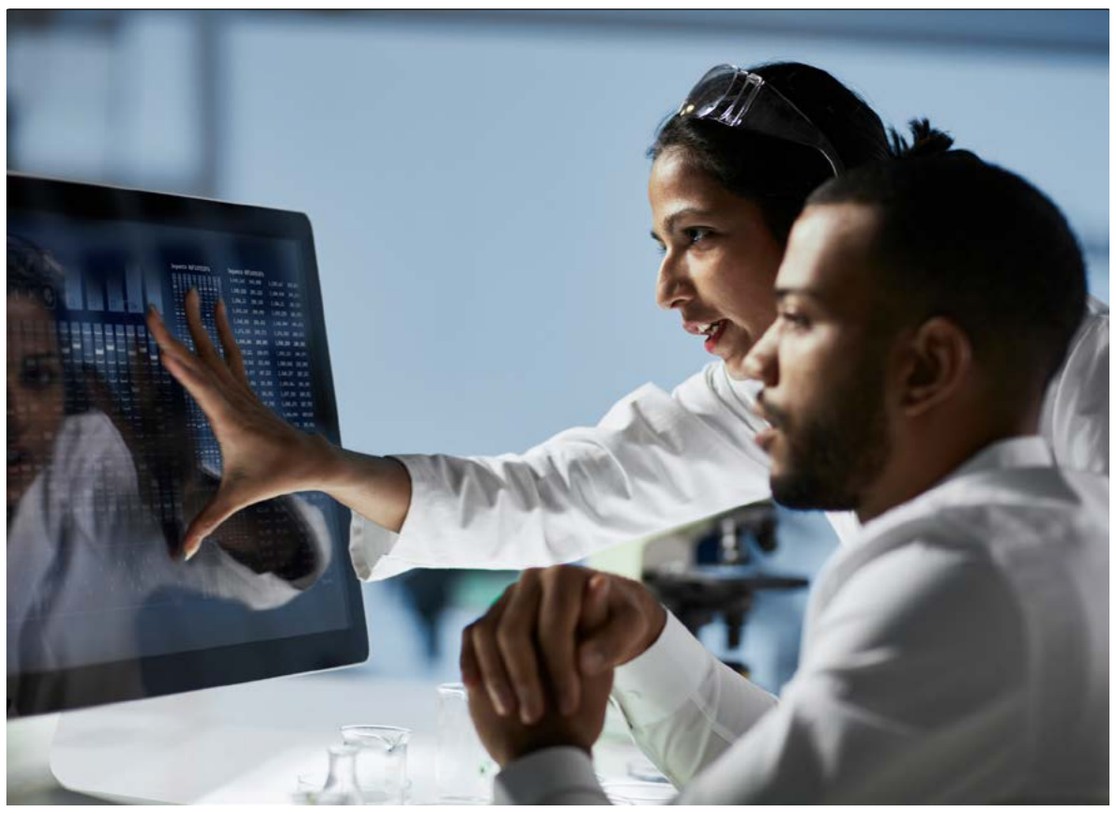


Simplifying the data stack: why businesses need a real-time upgrade

Data leaders are under pressure to deliver on real-time use cases over data that's growing exponentially, but how can they get there with a traditional data stack not suited for real-time?

Data can be key to solving business problems, but only if decision-makers have the ability to access it while it's still relevant. Finding out what action should be taken now is more important than determining what should have been taken yesterday. CDOs are under pressure to manage vast amounts of data at an unprecedented pace: delivering data and insights in real-time is important across every type of business and in every aspect of those businesses.

Product teams that get usage insights in seconds instead of days can increase user adoption and reduce churn. Stock and cryptocurrency analysts who can stream and analyse trading data instantaneously have an advantage over their market peers in identifying the most profitable trades. Ecommerce stores that run analytics with millisecond latency can instantly personalise the shopping experience delivered through a seamless UX, boosting conversion rates and revenues. Regardless of industry or product, real-time analytics improves the KPIs that data leaders - and their stakeholders - care about.

But getting to the stage where product development teams can make use of data at scale is easier said than done. Businesses process huge volumes of data each day from numerous sources, stored in multiple ways by multiple people across the organisation. Data warehouses are well equipped to store unified data that supports specific analytics needs, but handoffs and delays are often hard to avoid while data is being batched and processed. Even minute delays may have ripple effects that impact user experience, and acting on analytical queries in real-time is not tenable, with the value of the insights they provide dropping as the minutes tick by.

Data leaders must rise to the challenge of building or rebuilding data infrastructure that ensures everyone can get the data they need when they need it. In theory, closing the gap between analytics and action can be achieved internally. The instinct may be to throw data engineers, time, and money at the problem in the hopes of improving latency or concurrency metrics. But this also means diverting substantial resources away from the actual business of the business - and away from improving the product.

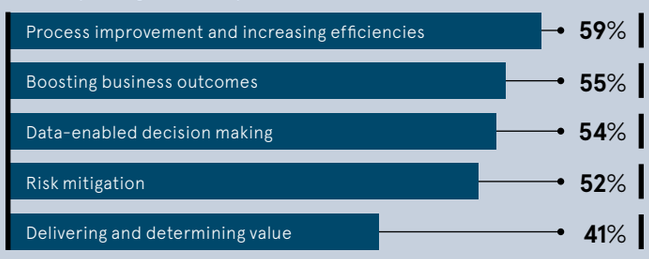
Jorge Gomez Sancha, co-founder and CEO of Tinybird, knows that engineers are often used to managing their own data infrastructure, which brings with it a score of things to think about, from basic server configuration to the intricacies of developing secure, low-latency, high-concurrency endpoints.

"'What's the right CPU level, the right number of CPU cores, or amount of memory? Should I use replication or sharding? How do I keep track of whether everything is up and running?' They're thinking 'we need a database that we then build things on top' versus 'we need tools to solve our problems with data'," says Sancha. "Your developers shouldn't even need to think about any of that, they should be thinking 'What's the next business problem I can solve and provide value?'" Sancha believes that data leaders should focus on enabling developers to apply analytics within the products they build in as close to real-time as possible.

In many cases, the problems data leaders need to solve in order to give developers access to real-time analytics are not unique. Almost every CDO or head of data is confronting or has confronted the challenge of building real-time data architecture. But why is it so challenging to solve? Data warehouses weren't built for real-time, but data teams have spent the last decade investing in infrastructure and tooling that surrounds and supports the data warehouse. To solve for real-time use cases, data leaders will need to branch out.

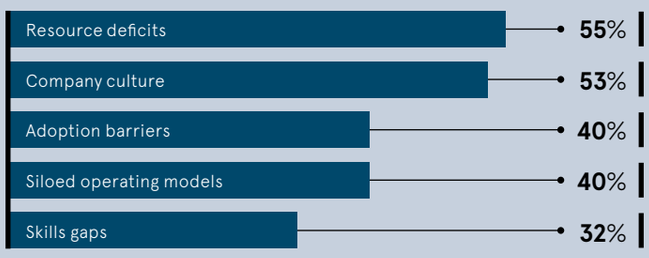
DATA LEADERS ARE STREAMLINING PROCESSES AND STRIVING FOR GROWTH

CDOs' top data governance priorities



But meeting these goals is not without its challenges

CDOs' top data governance obstacles



Evanta, 2022

But why start from scratch when tools like Tinybird are already solving the problem? Increased performance and precision are core goals for any CDO, and streamlining these processes requires the right set-up. Data teams that use a serverless approach with best-of-breed software can integrate with existing streams, databases, and warehouses, process them through an optimised and simplified data stack, and then provide near-instantaneous access on the other side - often in a way that complements the traditional data warehouse. These serverless tools can plug into dashboards, trigger alerts, power automation, or feed into whatever other data products the business uses.

> **Developers should be thinking: 'What's the next business problem I can solve and provide value?'**

Sancha points to Keyrock, a Tinybird customer operating in the cryptocurrency market, as a prime example: "they ingest data from markets all across the world, in crypto but also in other assets, and then they are constantly making bets as to where things are going and creating transactions." Inevitably this involves a massive amount of data, and Keyrock was battling a host of latency, freshness and concurrency issues. Data took many seconds or even minutes to process and hand off, and even went missing entirely, making it challenging to analyse and act on that data in real-time. In such cases, attempting to fix the issue internally was costly and time-consuming: using Tinybird proved a far more efficient solution.

Data teams that add real-time architecture to their stack often discover opportunities to apply the tech to new, tangential use cases that have sat unresolved. Sancha remarks on a client who had initially transitioned to a real-time architecture to reduce the lag time in their analytics platform. This shed light on a new solution to an old problem - could real-time analytics be the key to identifying and preventing denial-of-service attacks on their services? Implementing instant logging and analytics enabled them to turn hours of work into an automated process that could effectively intercept and respond to attacks within minutes. Once the value of real-time data becomes evident in one area, different teams across the business will find that they rapidly develop new ways to apply real-time across everything they do.

Data leaders need to give developers the tools to make actionable use of the data that's pouring into their databases at a moment's notice, and waiting minutes to understand what's happening while their competitors wait seconds or milliseconds is not a sustainable option. They need real-time data architectures with an emphasis on simplicity and performance. Having the data to make critical business decisions isn't enough; developers and data teams need to be able to build data products that can have a real-time impact at any scale. CDOs and heads of data need to act now to realise this, as the size of their data is only accelerating.

CONSOLIDATION

Amalgamate to accumulate

The task of breaking down data silos may seem time-consuming, complex and costly, but letting disparate legacy systems atrophy in isolation is likely to prove more expensive in the longer term

Finbarr Toesland

The widespread adoption of powerful analytical tools and AI-based systems that can offer insights into everything from operational efficiency to consumer behaviour has had a clear positive impact on businesses worldwide. Yet, despite such advances, even the most forward-thinking companies are still likely to have data silos that are preventing them from performing to their full potential.

"It doesn't matter whether you're a start-up or a large corporation – silos will exist if different departments inside your business store their data in separate locations," says Mihai Cernei, CTO at Amdaris, a specialist in digital transformation. "As these disparate assets grow, so do your silos."

The existence of silos makes data analysis a far more time-consuming process than it needs to be. And, if similar material is being stored in numerous places, inconsistencies can easily creep in, jeopardising the quality of the information extracted.

IT specialists faced with a lack of joined-up platforms tend to devote more effort to data management than they might wish to. A 2020 Gartner survey of data professionals found that on average they were spending 56% of their working time on routine data management work. That meant they were spending only 22% of their time on more value-adding tasks such as data monetisation and the extraction of valuable insights.

Every company will have its own unique set of data consolidation problems to overcome. In Cernei's experience, nearly every obstacle a business will face in its efforts to bring together fragmented data falls into one of three categories. First, it's becoming increasingly difficult to find high-quality technical experts who can do this work. Second, the task of even accessing many legacy systems requires either bespoke software or new data connectors to be built. Third, and perhaps the most significant factor for firms looking to eliminate data silos, is that the process tends to be expensive.

"Some integration is costly and requires a lot of computer power," says Cernei, although he adds that it's "important to note that this isn't true of every solution. Some can save you money."

Chris Gorton is a senior vice-president at Syniti, a specialist in enterprise data management. He recommends that the first step any organisation should take when attempting to break down silos is to obtain a comprehensive understanding of exactly what data it wants to gain control over.

> **One practical step towards making progress on data, while also keeping an eye on cost, is to align data towards business strategies**

"Companies need to develop a plan to consolidate information, harmonise duplicated material and ensure that it's of a high quality, so that it can be trusted and used throughout the business," Gorton says.

As data-synchronisation work can affect all parts of an enterprise, it's vital that this plan factors in how all operations can keep running seamlessly as the process gets under way.

Many business leaders are facing budget constraints that will require them to make hard choices about which projects need to be prioritised and which ones can be shelved until more funds are available. If they are to approve a data integration project, members of the C-suite will therefore need to see a strong business case for it.

"Are there any quick wins that would increase overall acceptance for making the change? If so, this could be an opportunity to save money, reduce risk and create efficiencies that will drive greater acceptance from the whole business on why this should be done," Gorton suggests.

Replacing outdated software and hardware is a key element of any plan to remove silos. The longer that legacy systems are left unmodernised, the more work will be required further down the line when they cause compliance and security problems, hinder innovation and restrict growth.

The emergence of cloud-based integration solutions has made it easier than it's ever been to eliminate silos caused by the continued use of obsolescent systems. Data lakes, in which all forms of data can be held and made accessible, can be a particularly effective tool.

Mike Haresnape, director at business intelligence consultancy Dufrain, explains that consolidating the material into such platforms enables a firm to "model different data sets and join them together. It can then meet any number of reporting, analytical or machine-learning use cases."

He adds: "Organisations can cut costs and time spent on data extraction by ensuring that, whenever an application is enhanced, its data is moved to another platform. Taking advantage of relatively low storage costs and landing large data sets in the cloud or on the premises can also help with this."

But it's no secret that data consolidation programmes of this type are notoriously difficult to get right. Gartner estimates that about 85% of big data projects will fail to meet all their objectives, illustrating the scale of the challenge that businesses face when trying to get a handle on complex and disparate data from across the enterprise.

Using a mix of integration solutions is unlikely to succeed unless a comprehensive data governance system is embedded throughout the organisation. In practice, this will necessitate a range of standards, processes, policies and metrics that define clearly how data is used to best meet the goals of the business.

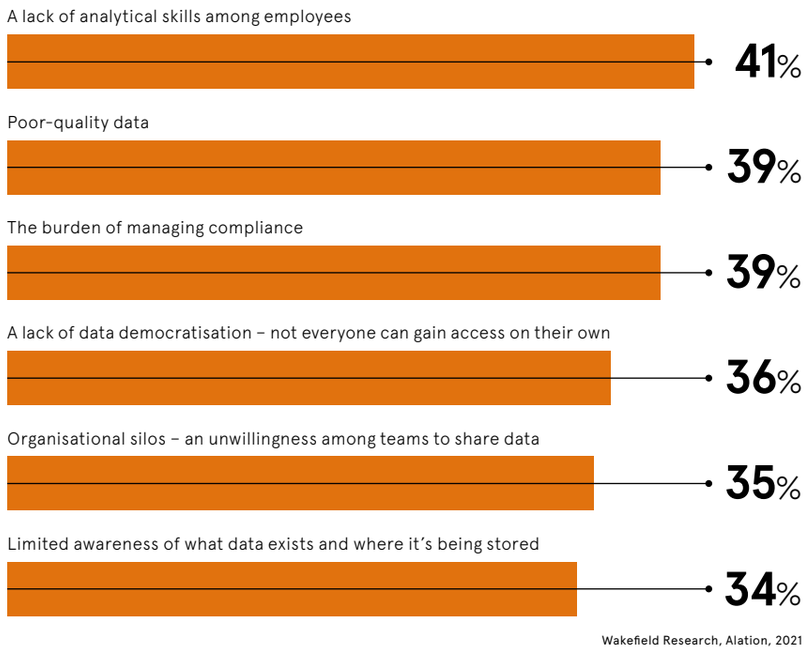
"One practical step towards making progress on data, while also keeping an eye on cost, is to align data towards business strategies," Haresnape says. "A data governance strategy needs to add extra value, be tailored to the organisation and focus on data that's relevant to its activities."

A well-implemented data governance strategy can result in both data quality improvements and the ability to create a map indicating the location of business-critical material. With businesses continuing to generate huge volumes of data on customers, suppliers, employees and more, data governance will become an increasingly important part of any method of dealing with silos.

There's no question that the initial outlay required to break down data silos can seem excessive. But the potential benefits of establishing a 'single source of truth', enabling all decisions to be based on the same information, mean that it's less of a cost and more of an investment in the future of the business.

SILOS ARE AMONG THE BIGGEST BARRIERS TO THE USE OF DATA TO FUEL GROWTH AMONG LARGE COMPANIES IN NORTHERN EUROPE AND THE US

Percentage of senior executives in the data analytics function citing the following as limiting factors in their firms



Wakefield Research, Alation, 2021

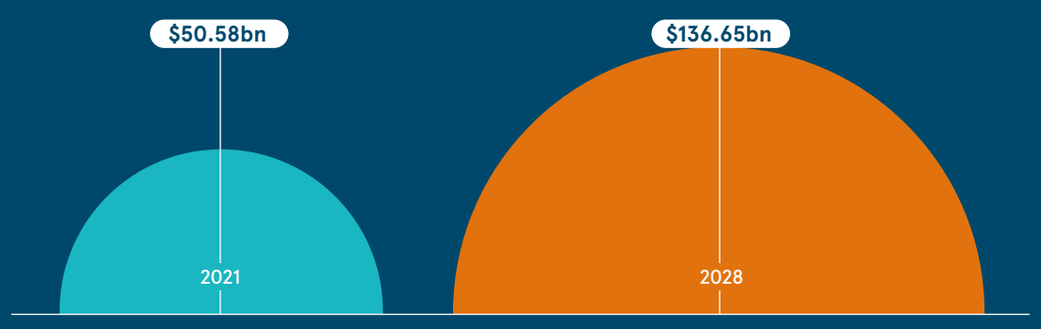
BIG DATA STORAGE

Big data analytics is an advanced technology that's helping businesses in many sectors to achieve their commercial goals. But where is all of the material it uses being stockpiled? While some companies invest in storage and processing centres on their own premises, the sheer volume of data will often demand the use of off-site, hyper-scale repositories

DEMAND FOR STORAGE SPACE IN COLOCATION DATA CENTRES IS SET TO RISE

The market's projected revenue growth from 2021 to 2028

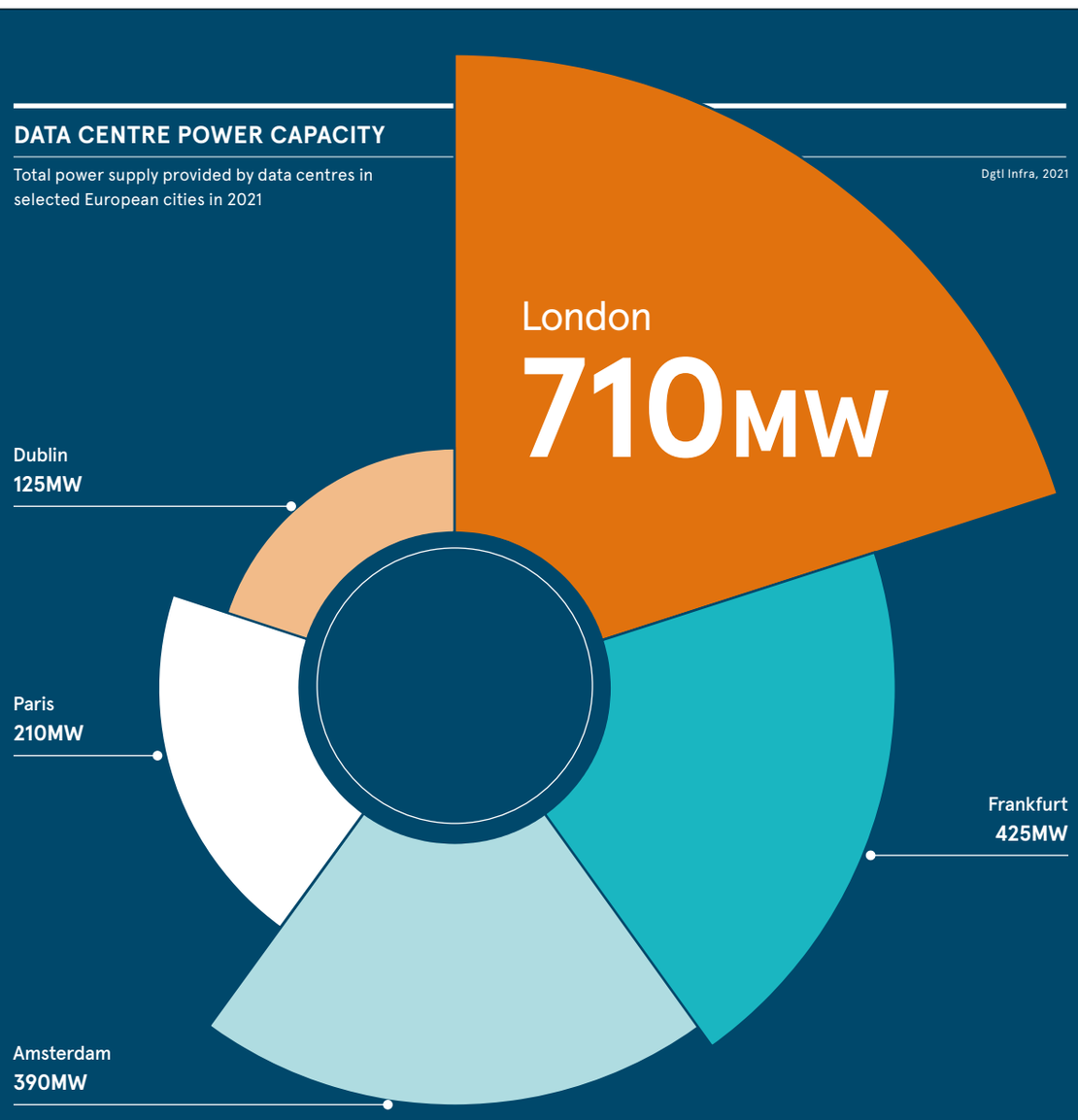
Vertiv, 2022



DATA CENTRE POWER CAPACITY

Total power supply provided by data centres in selected European cities in 2021

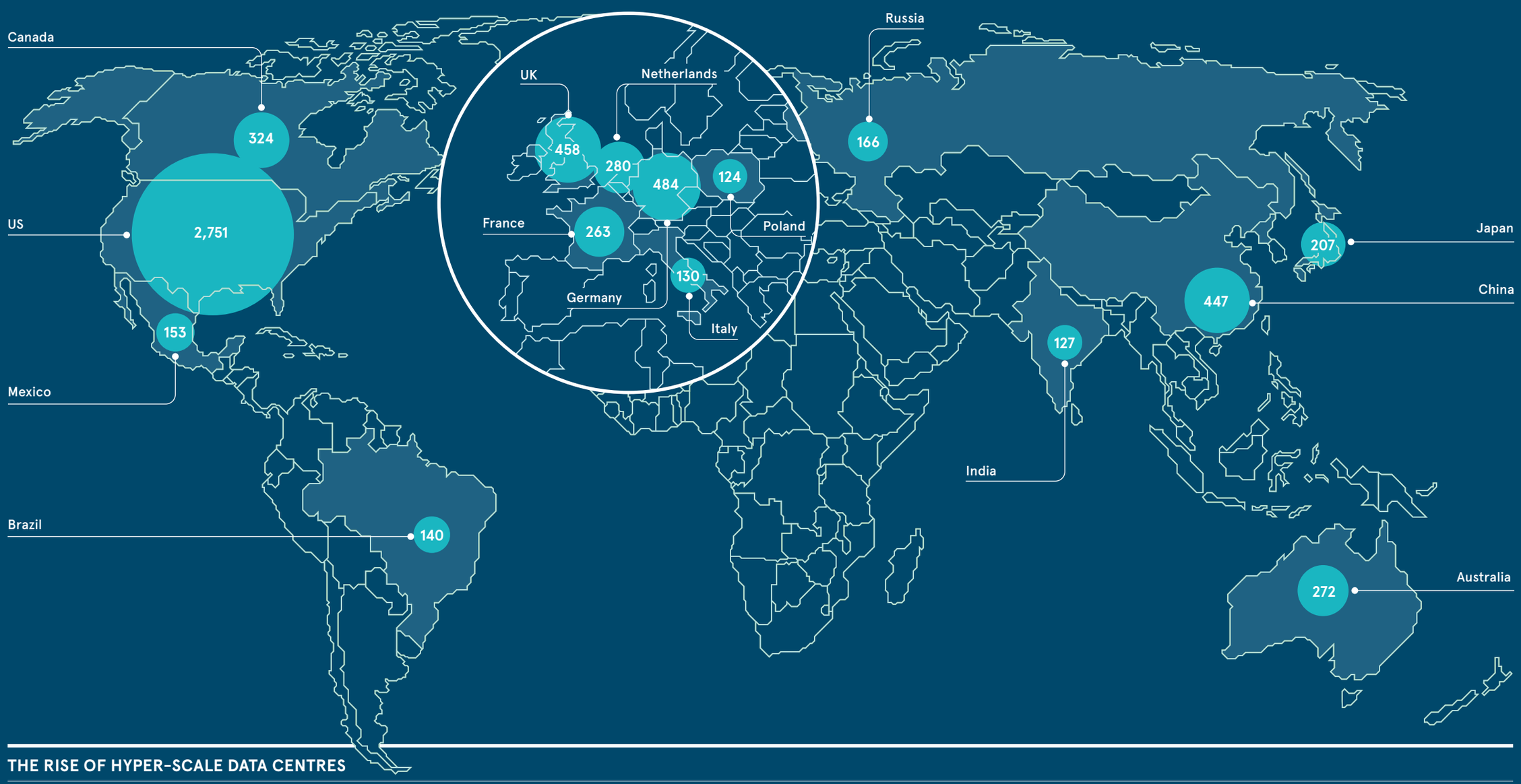
Dgtl Infra, 2021



THE MOST POPULAR LOCATIONS FOR DATA CENTRES

Number of centres known to exist in selected countries

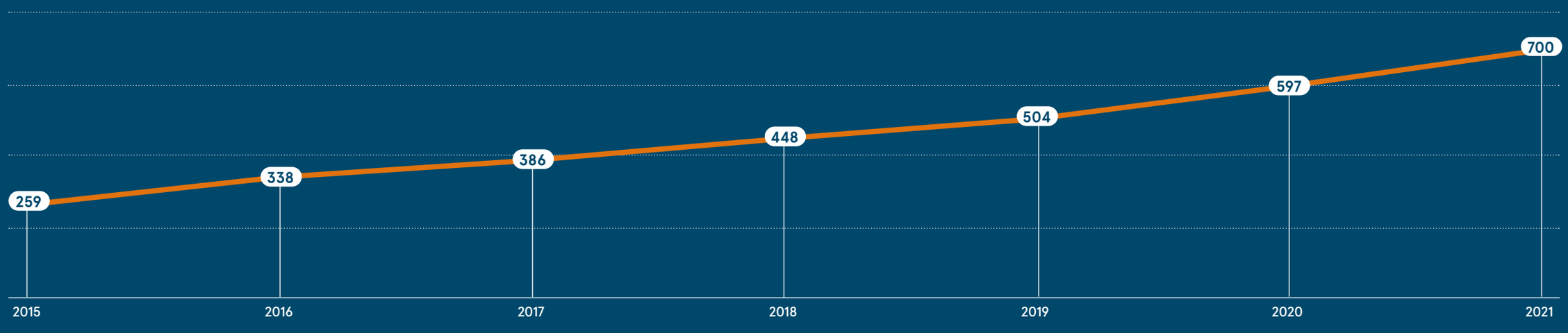
Cloudscene, 2022



THE RISE OF HYPER-SCALE DATA CENTRES

Number of large centres housing thousands (or millions) of servers in existence between 2015 and 2021

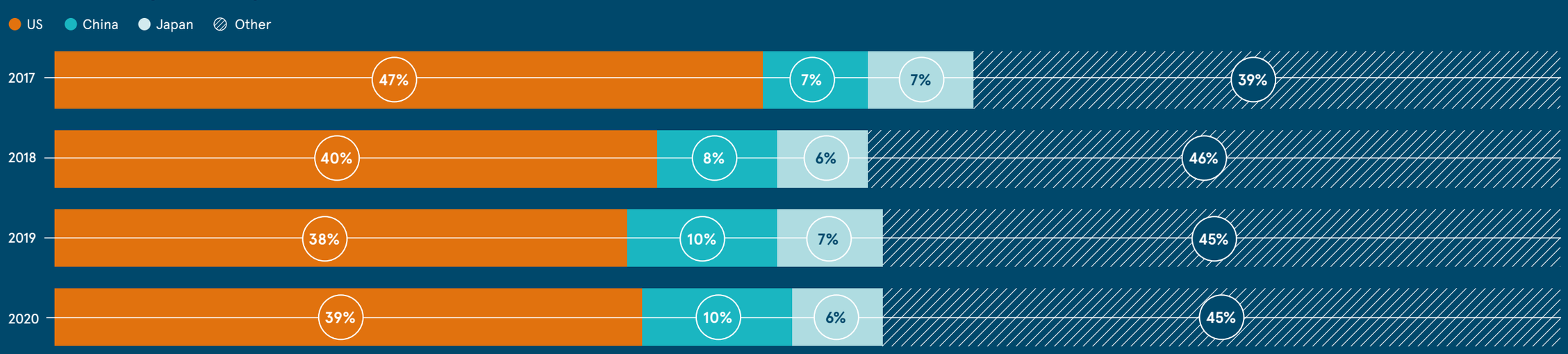
Synergy Research Group, 2021

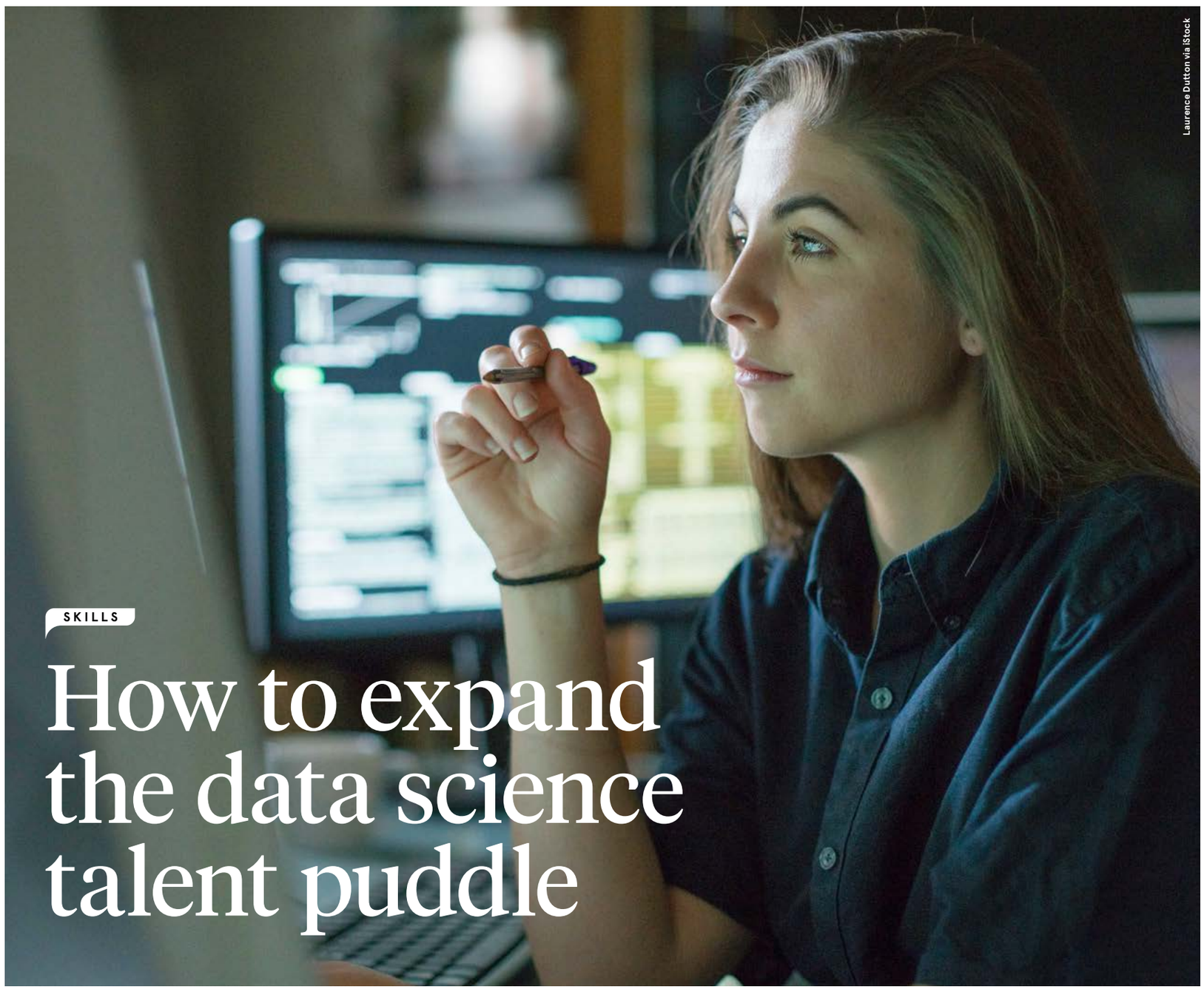


MAIN LOCATIONS OF HYPER-SCALE DATA CENTRES

Global distribution of large centres housing thousands (or millions) of servers between 2017 and 2020

Synergy Research Group, 2021





Laurence Dutton via iStock

SKILLS

How to expand the data science talent puddle

As demand for data scientists looks set to outstrip the supply for several years, employers would be well advised to broaden their search and make longer-term investments in training and development

Alex Wright

The volume of data that businesses handle has increased exponentially in recent years – and so has their need for the skilled professionals who can analyse and interpret all this material. The problem is that there is a huge disparity between the supply of data scientists and the demand for them.

To give an idea of the scale of the talent shortage, there are about 210,000 job adverts for data scientists on LinkedIn alone, according to research by the International Data Corporation. Among the most highly sought-after skills are information management, statistical analysis and programming. Recruiters are especially keen on candidates specialising in fast-evolving fields – machine learning and customer analytics, for instance – who can interpret the data these systems generate and recommend appropriate plans based on it.

Zoë Morris, president of Frank Recruitment Group, believes that companies need to adopt a "people-first mindset" to bridge the skills gap. That requires them to adopt a multi-pronged strategy that looks beyond the limited pool of immediately ready candidates and makes longer-term investments in people.

"Providing learning, development and training opportunities that enable professionals to upskill is the first step in doing this. This is likely to improve attraction and retention in the process," Morris says. "Businesses also need to diversify their talent pipelines, expanding their reach to become more inclusive."

To this end, firms must put a robust diversity and inclusion strategy in place to attract and retain a wider range of people. Candidates brought in from varied backgrounds and industries can bring valuable new perspectives and experiences to the team. Employers also need to offer recruits the option of flexible working, so that they can be at their most productive and engaged at work, while maintaining a healthy and fulfilling lifestyle.

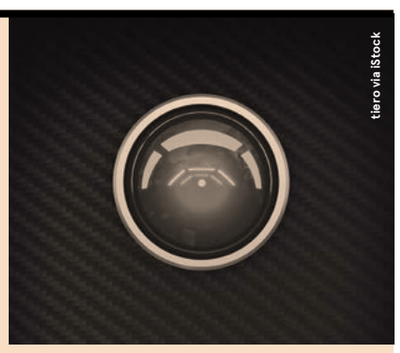
Some companies have already adopted such an enlightened approach. They are looking for candidates with foundational capabilities, such as an aptitude for logical and quantitative reasoning, and then training them in the principles and practices of data science. Others are hiring not only from different sectors, but also from different regions.

Philip Linardos is co-founder and CEO of ShelfNow, a London-based online trading platform. He says that his firm has sometimes "looked to hire overseas talent, as we are a Europe-wide company that works with several EU countries. In addition, while we have waited to find the perfect person for data science roles on occasion, we have redeployed skills accordingly."

Tertiary education providers clearly have a big role to play in equipping tomorrow's data scientists with the requisite knowledge and skills. Indeed, several universities and colleges are establishing new bachelor's and master's degree courses or updating their existing programmes in data science.

Employers can collaborate with these providers by, for instance, helping them to fine-tune their curriculums. They can

Artificial intelligence: friend or foe?



tiero via iStock

There is a fear among data scientists that automation will eventually put them out of a job. AI-based systems are already being put to work on several simple tasks – producing basic data models, for instance.

A research report published by Gartner in 2017 predicted that about 40% of data science work would be automated by 2020. While the accuracy of that forecast is moot, it's widely expected that the technology will take on more challenging and complex tasks as advances in AI continue to be made.

Since data scientists are required to maintain the technology, AI can never fully replace them. Humans are needed to guide the first iterations of machine-learning models and initial inputs, as well as to identify new opportunities for the business, which AI will still often miss.

"While it is true that some technologies can dramatically improve the performance of data scientists, we are further away from AI replacing them than ever," argues Kjell Carlsson. "The ongoing struggles of vendors in the machine-learning space that have promoted the myth of the 'citizen data scientist' can be seen as evidence of this. Instead, the opposite is happening: AI is making data scientists much more productive and impactful. Demand for them is therefore increasing rather than decreasing."

Instead of viewing machine learning as a competitor, data scientists need to embrace the technology, using it as a tool that enables them to focus on more valuable work. That said, they will need to update their skills constantly to ensure that they stay abreast of developments in the field.

AI enables data scientists to generate hundreds or even thousands of variations of models with different prediction features and to create more complex iterative data simulations to choose the best variation. By working together, data scientists can use AI as a digital assistant that can automatically test, iterate and monitor data quality; incorporate data points as soon as they become available; and ensure that they can react quickly to new developments.

"In the world of data science, the main task is not to train a new model. First, you have to do a feature engineering process, which sometimes requires a lot of imagination," observes Andrew Lane, founder and CEO of Acuity Trading. "As long as we never teach AI how to imagine, data professionals' jobs will be safe."

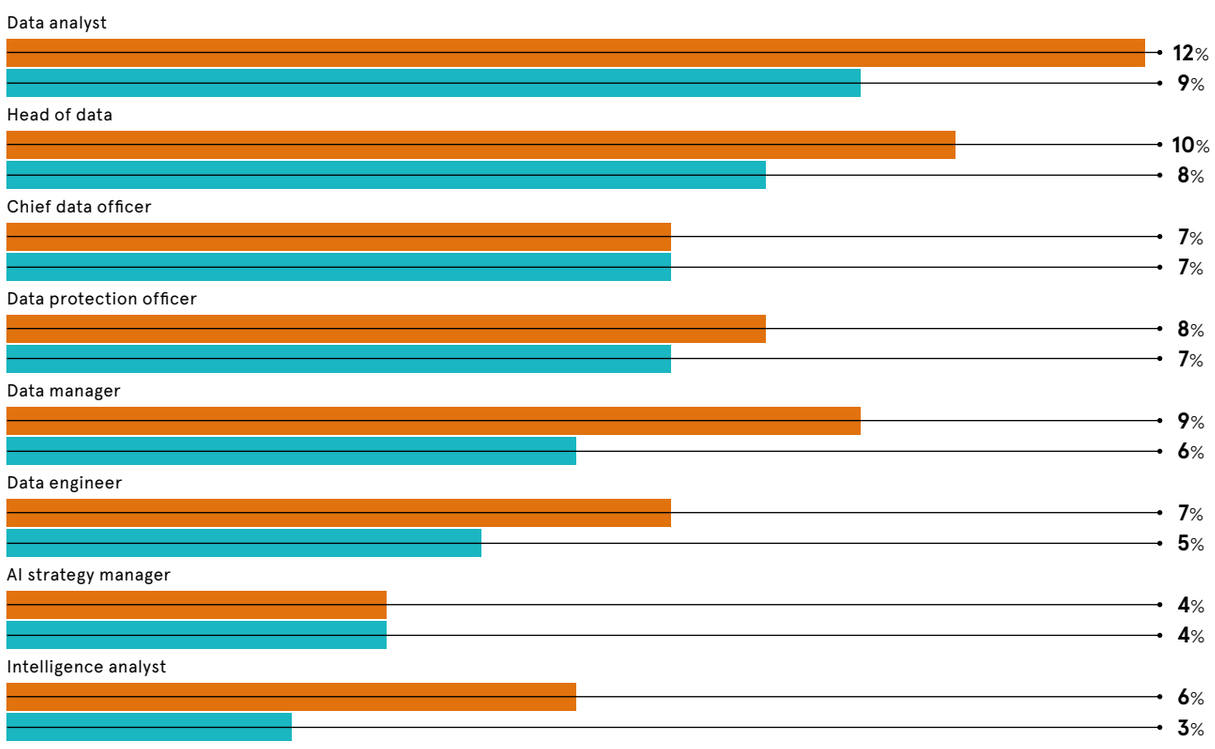
295%

Growth in the number of data science-related tasks set by recruiters during interviews last year

DevSkiller, 2021

HARD-TO-FILL VACANCIES

Percentages of UK businesses that were recruiting – and struggling to recruit – for selected data jobs in 2020 and 2021

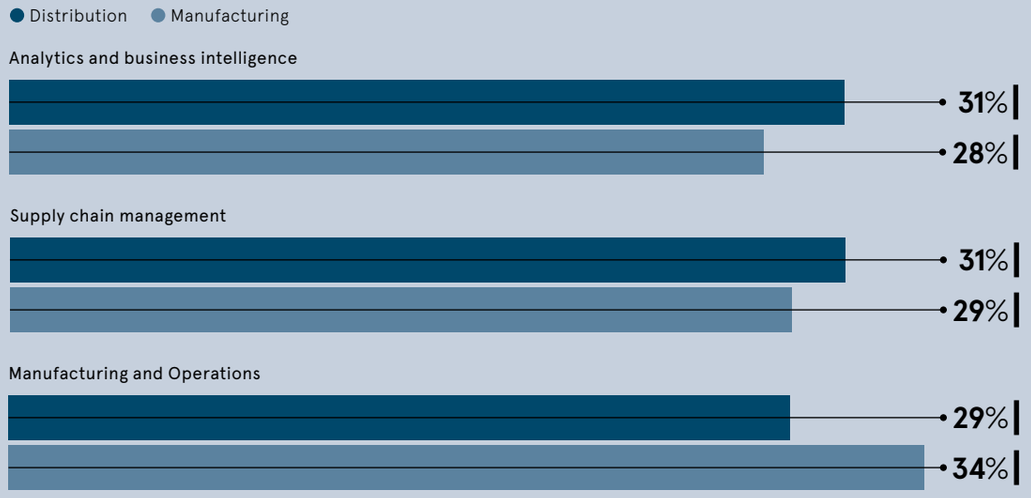


Gov.uk, 2021

CLOUD ERP CAN SUPPORT CRUCIAL BUSINESS FUNCTIONS

Top three areas of business that companies would use cloud ERP to address

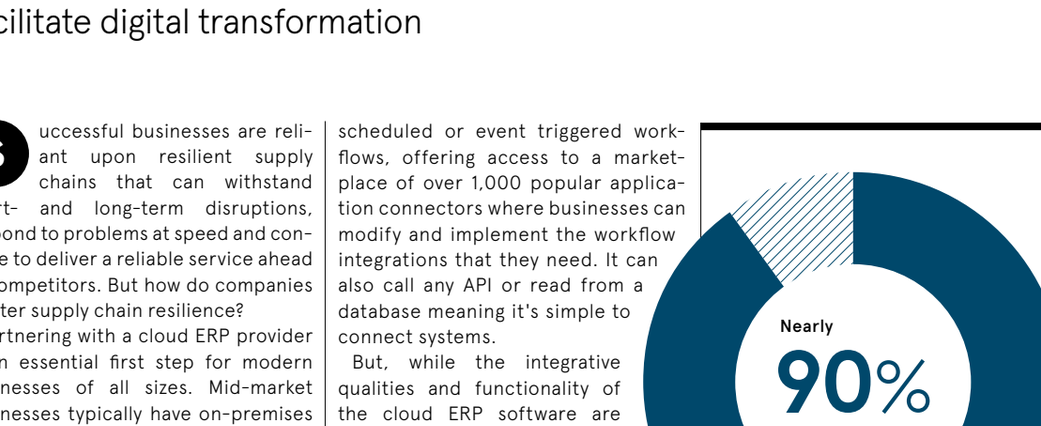
Epicor, 2022



CLOUD PROVIDER SUPPORT CAN BOOST CONFIDENCE IN ERP SOLUTIONS

Types of data support that help in-house teams when migrating to the cloud

Epicor, 2022



work with universities, colleges and even secondary schools to generate awareness among students using events such as careers fairs. They can provide internships and work-experience placements giving direct exposure to the role. They can also offer scholarships and other funded routes into the profession.

"Passion for data science starts young – and it needs to be encouraged," argues Mark Mamone, group CIO at GB Group, a specialist in digital identity verification. "Apprenticeships and work-experience placements, as well as graduate training programmes, are therefore vital. Working with communities that support inclusion, diversity and equality in this field – the Women in Tech Forum, for instance – is also key to attracting diverse talent and building a successful team."

Microsoft has partnered with the University of London and US institutions Purdue University Global and Bellevue College to provide blended and flexible learning opportunities based on its own technical courses in fields such as data science. Similarly, Infosys has enrolled 150 new workers in a six-week full-time programme at North Carolina University to improve their knowledge in foundational areas such as statistics, data visualisation, machine learning and Python programming.

> **Passion for data science starts young – and it needs to be encouraged. Apprenticeships and work-experience placements are therefore vital**

Stephanie White is a director at EC1 Partners, a recruitment agency specialising in fintech. She reports that several universities are helping students by offering them sandwich-year industry placements.

"This means that, when graduates enter the jobs market, they already have some relevant business experience rather than just knowing the theory," White says. "This equips them better for the work, which makes them more valuable to employers."

Once a company has assembled the right team of data scientists, the hard work doesn't stop there. The members need regular training, delivered through deep learning models, to keep their skills up to date in a particularly fast-moving discipline.

"To solve their data science gaps, companies need to adopt a people, process and technology perspective," advises Dr Kjell Carlsson, head of data science strategy at Domino Data Lab. "They must be far more diverse in their recruitment, training and evaluation processes. And they need technology that supports such diversity and makes people more productive, more collaborative, more impactful and, ultimately, more fulfilled."

No one can know for certain how jobs in data science will evolve in the medium to long term. But having a well-planned and resourced recruitment process in place is key to maintaining a supply of talent that can keep pace with advances in the field.

"The technology is moving fast, but the skills required from a data science perspective are falling behind," warns Andrew Scotts, EMEA head of front-office technologies at EC1 Partners. "Companies need to stay on top of the changes and ensure that their employees are equipped with the right skills at all times." ●

INSIGHT

'Data is moving into the business and forming interdisciplinary teams'

The rise of data is not only transforming organisations; it's also changing the role of the CIO. As the spotlight turns from the chief digital officer to the chief data officer, Andrew Pryor, co-founder at CIO WaterCooler, considers whether the latter could emerge as the key IT leader at board level

With data flowing into them from all corners of the cloud, organisations are seeking to squeeze out every drop of value from it, capitalise on AI technologies such as machine learning and become truly data-driven businesses.

As the head of IT innovation at a large manufacturer recently told us: "Our whole business model is now based on predictive technologies."

We at CIO WaterCooler have observed the CIO role spawning all kinds of specialised mutations – a process that has accelerated in recent years. In particular, we have witnessed the rise of the chief data officer (CDO), especially in the financial services sector, as the senior IT leader to deliver on the promise of data. In the decade after the emergence of Web 2.0 and cloud computing, many CDOs joined senior management teams.

Yet most organisations in the UK still don't have a CDO yet and would freely admit to being in the early stages of the so-called data maturity curve. The CTO of a London-based security services firm told us that his organisation has a lot of data, "but it is all over the place in silos". The company's big project this year is to bring all that material together, cleanse it and consider its use for AI solutions.

But the centrality of data in modern organisations is ultimately forcing further evolution in the role of the CIO. Companies are hiring data scientists because everybody else is doing it, yet few have the right mindset to be truly data-first organisations.

Where will data scientists sit in the organisation? Not under IT, according to the UK-based CIOs in our community. Most are embedded in the business, but some organisations have been building out their data science capability with external partners such as IBM and Infosys, or creating a new internal data organisation.

A veteran CIO working at a charity told us that she has observed "a range of healthy to unhealthy tensions" between the IT and data science functions. IT understands data management and the value of data, but data science needs to be out in the business. Although IT should provide "an architecture with the right systems and data-capture processes", she is "not convinced that the data scientists then sit best within an informatics organisation".

The data function is moving into the business and forming interdisciplinary teams. It's following the general trend of IT, which no longer works in a silo.

A global CTO of an information service told us: "Our teams are genuinely hybrid and I work very closely with our COO, CPO and CDO to ensure that we have an integrated strategy."

Where will that leave the CIO? The CIO role was already morphing into a more general strategic position – a chief innovation or transformation officer. We have seen CIOs become COOs when they reach board level. In the ideal scenario, the CDO would be an equal partner of the CIO. The CDO wouldn't be able to succeed without the CIO's support. But the trend is that the CDO reports to the business, the CEO, COO or CFO, not to the CIO.

The role of CDO is generally poorly defined. It is characterised by high expectations and too little power, which sets the incumbent up for failure. But that situation is likely to change. The role could evolve, taking responsibilities and influence from the traditional CIO. Data science and a CDO position would then become the main path to a board-level IT or innovation leadership role. ●

Andrew Pryor
Co-founder,
CIO WaterCooler

How the cloud facilitates improved data management

Cloud ERP software is giving businesses the power to respond to disruption remotely at speed, forecast problems before they occur, boost data security and provide a central hub to facilitate digital transformation

Successful businesses are reliant upon resilient supply chains that can withstand short- and long-term disruptions, respond to problems at speed and continue to deliver a reliable service ahead of competitors. But how do companies bolster supply chain resilience?

Partnering with a cloud ERP provider is an essential first step for modern businesses of all sizes. Mid-market businesses typically have on-premises ERP systems or IT solutions but have not yet made the switch to the cloud. Doing so will help them better manage their supply chains, procurement, manufacturing and other daily activities.

But Covid-19 and variables such as supply chain and distribution challenges, heightened demand and labour shortages, as well as the soaring cost of energy and raw materials, have accelerated the demand and need for real-time data and remote access to enable businesses to make swift and accurate decisions. This is enabled by cloud technology.

"When implemented correctly, cloud ERP software enables ecommerce at the speed of light," says Andy Coussins, SVP & head of international at ERP software provider Epicor. "Businesses can keep track of supply and demand, ensure accurate forecasting and enable strategic planning while staying compliant in today's challenging and complex global economy."

But the decision to move to the cloud or change ERP provider isn't taken lightly. Most businesses use a range of different software to run different business functions, whether it's for sales, customer service, payroll or other operations. Epicor's ability to integrate with these other platforms allows businesses to seamlessly control their operations and ensure their data is secure in the cloud.

Epicor's Industry ERP Cloud solutions are industry-specific and tailored to seamlessly integrate with existing technology. Key to this is Epicor Automation Studio, a pioneering low code integration platform-as-a-service (iPaaS) which allows companies to integrate and automate activities and processes between previously siloed applications data and platforms.

Automation Studio empowers workers to easily integrate and automate scheduled or event triggered workflows, offering access to a marketplace of over 1,000 popular application connectors where businesses can modify and implement the workflow integrations that they need. It can also call any API or read from a database meaning it's simple to connect systems.

> **When implemented correctly, cloud ERP software enables ecommerce at the speed of light**

But, while the integrative qualities and functionality of the cloud ERP software are essential, the relationship between the business and provider is equally important. The Epicor Industry Insights Report 2022, which surveyed 1,350 technology decision makers, revealed that most leaders consider changing providers every one to three years.

A common reason for switching providers is poorly managed implementations as a result of poor communication with key stakeholders. "The key to a successful long-term partnership with an ERP provider is to ensure the relationship is aligned at the right level," says Coussins. "ERP solutions run the business and hence should be aligned with the people that run the business, not just IT. "Previously, software was seen as an IT concern – and some software is, such as collaboration tools and productivity applications – but ERP software is very different and failure to recognise and align is destined to cause operational turbulence."

If businesses can partner with a cloud ERP provider that offers smooth integration and robust communication, then the foundations are in place for digital transformation to occur.

Epicor's cloud ERP acts as the digital foundation of the business forming the basis from which more and more parts of a business can be digitised and integrated. A key part of this transformation is enhanced security. Epicor's global team of experts are on hand at any time of day to take care of maintaining security updates, backups, and upgrades, enabling businesses to concentrate on running their company without worrying about data breaches. "Having the latest security solutions available in an elastic cloud far outweigh the server under someone's desk or in a data centre that isn't protected against natural or malicious disasters," says Coussins.

Similarly, data management is improved through cloud solutions. Businesses are better able to migrate legacy data onto the cloud, and clean and maintain their data when using Epicor's solutions. This enables that data to become a crucial business intelligence and insight asset.

Interoperability is another key feature of digital transformation facilitated by cloud ERP. Different departments can collaborate on one interface and have access to a single data source. For businesses expanding into new markets, it can also provide easy data sharing between different operations and business units in different countries. Configurability is another advantage, enabling modifications to match the needs of individual businesses, for example bespoke processes, collaboration techniques and documentation.

of distribution and manufacturing professionals agree that they are comfortable with cloud based solutions

Epicor, 2022

> **The key to a successful long-term partnership with an ERP provider is to ensure the relationship is aligned at the right level**

With supply chains set to face more volatility in the months and years ahead, partnering with a cloud ERP software provider is imperative for businesses that want to build resilience, undergo digital transformation and gain a competitive advantage over their rivals.

For more, please visit Epicor.com/IIR

EPICOR

CYBERSECURITY

Fighting the good fight – one exabyte at a time

As the migration of business to the cloud gathers pace, security specialists are becoming increasingly dependent on data analytics to detect suspicious activity across their networks


Glenn Carstens-Peters via Unsplash

Sean Hargrave

Data analytics has always been used in the war against cybercrime, but it's becoming firmly established in the front line of corporate defences as more and more businesses move their systems to the cloud and the criminals adopt increasingly sophisticated infiltration methods.

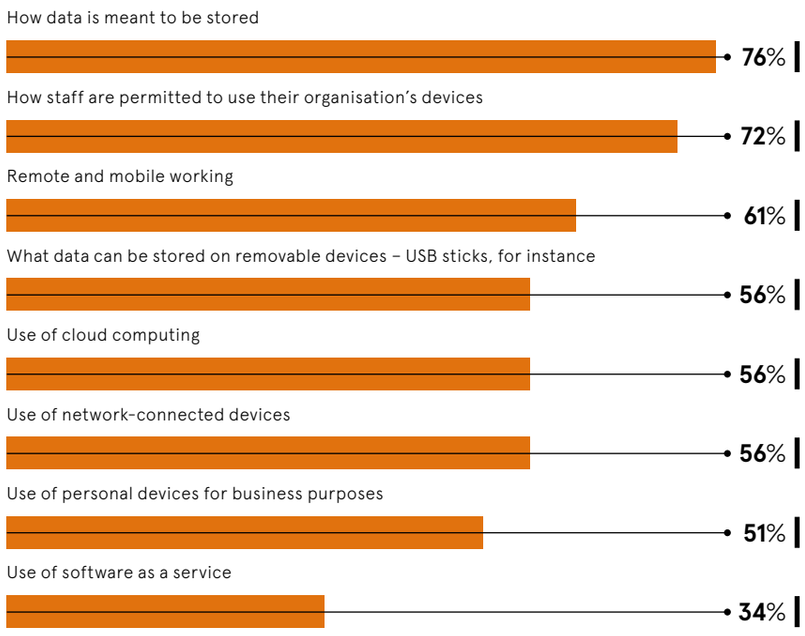
The simplest explanation for why data analytics has become so important is to consider the fundamental change that accompanies the move to remote hosting, according to Ryan Sheldrake, CTO for US cybersecurity company Laceworks in EMEA. When they host their own servers businesses have physical oversight, but that level of direct control is lost once a third party takes over their management.

"In the past, you could find a server affected by an attack on your premises and even pull the plug on it," he says. "With cloud providers, you may not even know where your servers are – and you certainly can't touch them. Instead, the providers trade that direct, physical control for mountains upon mountains of data, which is why analysing that data has come to the forefront of tackling cybercrime."

The rise of analytics in countering cybercrime is not only down to the mass of data that's become available to cloud users. The latest tactics adopted by highly sophisticated hackers have made threats harder to spot using traditional virus-detection methods, according to Adrian Nish, head of cyber at BAE Systems Digital Intelligence.

DATA STORAGE IS A PRIORITY IN CYBERSECURITY POLICIES

Proportion of UK firms citing the following as matters covered by their policies — Statista, 2022



"Viruses used to have the same signature code in them, so you could scan for these," he says. "But that is no longer the case – attacks have become more advanced and one-off, meaning that you can't look for signatures. Instead, you have to use data analytics to monitor network traffic in particular. There will be millions of pieces of data to look at. But, with the right analytics, you can see what doesn't look normal, such as something on your systems – a bot perhaps – regularly calling out or 'beaconing' to a third party for instructions. It might not be anything to worry about, but you can narrow the field with analytics."

That functionality is hugely important to organisations operating on the front line of the war against cybercrime. Arguably, there is no industry where this is more pressing than financial services. A security breach at a bank, say, could cause a system outage at the moment a customer is expecting their mortgage funds to come through for their dream home. It could even deprive people of their life savings.

James Fellows, CTO of the Coventry Building Society, reveals that data analytics has become the only way for it to keep track of network traffic. That's because the threats have altered, while what 'normal' looks like has also changed dramatically.

"Our customers have made a huge shift to ecommerce during the pandemic, which means we are adapting to new payments leaving their accounts at all times," he says. "And many of our employees are working from home and at different times of the day, so we have to get accustomed to a lot more unusual behaviour, such as someone logging on in the evening because they are working flexibly. We need to learn what's normal by feeding data into analytics packages that will flag up where we might need to investigate further, perhaps by calling the person concerned to verify that it was them logging on. You simply cannot do that type of safeguarding without using analytics to target where you need to be double-checking."

> **There will be millions of pieces of data to look at. But, with the right analytics, you can see what doesn't look normal... It might not be anything to worry about, but you can narrow the field with analytics**

It is here that data analytics requires powerful machine-learning tech to start building up a picture of what everyday traffic looks like, given the millions of interactions that flash across the average company's networks each day.

David Hoelzer, director of research at Enclave Forensics, thinks that this is the key reason why approximately 50% of the people who attend his cybersecurity lectures for the industry's Sans Institute have a background in data.

"About half of my students are data scientists who want to learn more about how to apply data to cybersecurity at their organisations," Hoelzer says. "The industry is moving to a point where data analytics is like a triage system that flags areas of concern, because humans cannot wade through millions of data points hoping to get lucky and find unknown malware."

He continues: "The trouble is that many industry vendors have been overpromising for years, claiming that they can spot unknown issues before they become a threat. Many people may be forgiven for thinking that they already have this cover – or not believing what they're being promised."

For Hoelzer, the risk is that, just as data analytics and machine learning are maturing to a point where they can accurately guide users to areas of unusual activity on networks, investment in them might be cut short. Given the power of analytics to narrow down the search for bad actors, this would be a mistake.

In particular, it would be a step backwards in cybersecurity because, according to Sheldrake, the next wave of innovation will take company defences to the next level, where anomalies are not only spotted but fixed automatically.

"We're moving to the point where AI will not only be able to use data analytics to guide security teams to where unusual activities are taking place," he says. "The next stage will be about using the data to find a problem and then solve it. These self-healing systems will be able to spot issues and then fix systems on the fly."

That is the ultimate promise of data analytics in defending against cybercrime. While the technology can already be used to cut down the noise of network traffic to highlight where threats may be lurking, in the future it will be able to investigate anomalies and then report back to the security team to confirm that it's detected a problem and dealt with it.


Chris Liverani via Unsplash

ARTIFICIAL INTELLIGENCE

The appliance of prescience

Advances in artificial intelligence are giving organisations in both the public and private sectors increasingly powerful forecasting capabilities. How much further down this predictive path is it possible for them to go?

Oliver Pickup

Minority Report, Steven Spielberg's 2002 sci-fi thriller based on a short story by Philip K Dick, explores the concept of extremely proactive policing. The film, starring Tom Cruise, is set in 2054 Washington DC. The city's pre-crime department, using visions provided by three clairvoyants, can accurately forecast where a premeditated homicide is about to happen. The team is then able to dash to the scene and collar the would-be murderer just before they strike.

While police forces are never likely to have crack teams of incredibly useful psychics at their disposal, artificial intelligence has advanced to such an extent in recent years that its powerful algorithms can crunch huge volumes of data to make startlingly accurate forecasts. Could a *Minority Report* style of super-predictive governance ever become feasible in the public sector – or, indeed, in business? If so, what would the ethical implications of adopting such an approach be?

There is a growing list of narrow-scope cases in which predictive analytics has been used to fight crime and save lives. In Durham, North Carolina, for instance, the police reported a 39% fall in the number of violent offences recorded between 2007 and 2014 after using AI-based systems over that period to observe trends in criminal activities and identify hotspots where they could make more timely interventions.

AI has also been used to tackle human trafficking in the US, where it has helped the authorities to locate and rescue thousands of victims. Knowing that about 75% of child trafficking cases involve grooming on the internet, the government's Defense Advanced Research Projects Agency monitors suspicious online ads, detects coded messages and finds connections between these and criminal gangs.

In Indonesia, the government has partnered with Qlue, a specialist in smart city technology, to predict when and where natural disasters are most likely to strike. Its systems analyse flood data collected from sensors and information reported by citizens. This enables it to identify the localities most at risk, which informs disaster management planning and enables swifter, more targeted responses.

While all these cases are positive examples of the power of predictive AI, it would be nigh-on impossible to roll out a *Minority Report* style of governance on a larger scale. That's the view of Dr Laura Gilbert, chief analyst and director of data science at the Cabinet Office.

"To recreate a precognitive world, you would need an incredibly advanced, highly deterministic model of human behaviour – using an AI digital-twin model, perhaps – with low levels of uncertainty being tolerable," she says. "It's not certain that this is even possible."

An abundance of information is required to understand a person's likely behaviour, such as their genetic make-up, upbringing, current circumstances and more. Moreover, achieving errorless results would require everyone to be continuously scrutinised.

"Doing this on a grand scale – by closely monitoring every facet of every life; accurately analysing and storing (or judiciously discarding) all the data collected; and creating all the technology enhancements to enable such a programme – would be a huge investment and also cost us opportunities to develop other types of positive intervention," Gilbert says. "This is unlikely to be even close to acceptable, socially or politically, in the foreseeable future."

Tom Cheesewright, a futurist, author and consultant, agrees. He doubts that such an undertaking would ever be considered worthwhile, even in 2054.

"The cost to the wider public in terms of the loss of privacy would be too great," Cheesewright argues, adding that, in any case, "techniques for bypassing surveillance are widely understood".

Nonetheless, Vishal Marria, founder and CEO of enterprise intelligence company Quantexa, notes that the private sector, particularly the financial services industry, is making great use of AI in nipping crimes such as money-laundering in the bud.

"HSBC has pioneered a new approach to countering financial crime on a global scale across billions of records," he says. "Only by implementing contextual analytics technology could it identify the risk more accurately, remove it and enable a future-proof mitigation strategy."

Alex Case, senior director in EMEA for US software company Pegasystems, believes that governments and their agencies can take much from the private sector's advances. Case, who worked as a deputy director in the civil service from 2018 to 2021, says:

> **To recreate a precognitive world, you would need an incredibly advanced, highly deterministic model of human behaviour**

"The levels of service being routinely provided by the best parts of the private sector can be replicated in government. In contrast with the dystopian future depicted in *Minority Report*, the increasing use of AI by governments may lead to a golden age of citizen-centric public service."

Which other operations or business functions have the most to gain from advances in predictive analytics? Cheeswright believes that "the upstream supply chain is an obvious one in the current climate. If you can foresee shortages owing to pandemics, wars, economic failures and natural disasters, you could gain an enormous competitive advantage."

The biggest barriers to wielding such forecasting power are a lack of high-quality data and a shortage of experts who can analyse the material and draw actionable insights from it.

"Bad data can turn even a smooth deployment on the technology side into a disaster for a business," notes Danny Sandwell, data strategist at Quest Software. "Data governance – underpinned by visibility into, and insights about, your data landscape – is the best way to ensure that you're using the right material to inform your decisions. Effective governance helps organisations to understand what data they have, its fitness for use and how it should be applied."

Sandwell adds that a well-managed data governance programme will create a "single version of the truth", eliminating duplicate data and the confusion it can cause. Moreover, the most advanced organisations can build self-service platforms by establishing standards and investing in data literacy.

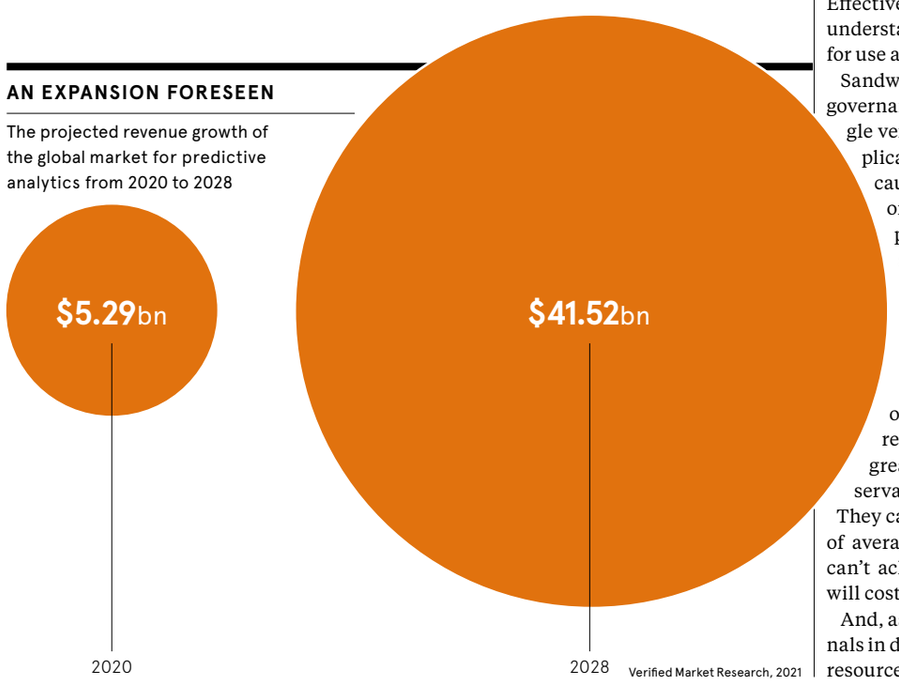
"Data governance enables a system of best practice, expertise and collaboration – the hallmarks of an analytics-driven business," he says.

Gilbert offers business leaders one final piece of advice in this area: recruit carefully. She argues that "a great data analyst is worth, at a conservative estimate, 20 average ones. They can often do things that any number of average analysts working together still can't achieve. What's more, a bad analyst will cost you both money and time."

And, as *Minority Report*'s would-be criminals in discover to their cost, time is the one resource that's impossible to claw back.

AN EXPANSION FORESEEN

The projected revenue growth of the global market for predictive analytics from 2020 to 2028



Verified Market Research, 2021

The CMO's guide to building data-driven consumer connections

High-velocity data marketing promises real-time answers to consumer demands, but to keep those promises, marketers need essential trust in their data

The right insights are fundamental to building watertight marketing strategies. More than ever, organisations are operating with a data-down approach to develop long-term loyalty, advocacy and engagement. To secure their seat at the top table, CMOs need to acquire new tools and market insights both strategically and organically.

However, marketers are at risk of becoming inundated with information. As the volume and complexity of the data that they must respond to snowballs, CMOs are struggling to identify reliable insights and translate them into decisions. A 2022 report by GfK and CMO Council revealed that 91% of marketers acknowledge the importance of responding to insights at speed in their role, but 55% only have slight or moderate confidence in their data analytics and insights.

In the current economic climate, companies should be harnessing high-velocity data marketing, not shying away from it – and making sure their companies support the effort. "Marketing budgets are going to be scrutinised in the year ahead, so being able to demonstrate the value of marketing data and the decisions it informs is essential," says Jutta Langer, vice president of consulting at GfK.

The accelerated pace of modern business leaves little room for second-guessing, and CMOs need to show their strength as data-driven leaders. To exceed consumer expectations, brands need to be sure that their data is highly relevant and optimised for quick decision-making. Langer continues: "If you don't have the right data insights, you will find it hard to deliver a consistent customer experience and you're more likely to miss out on opportunities because you don't see the signals." So how can CMOs ensure that they have the right timely data and solutions?

> **What organisations need is just a handful of relevant data sources, plus tech to help democratise and visualise it**

The first step is making data legible and available. Storing data for easy access can also be incredibly complicated, and companies are falling into the trap of pulling this information into silos that can't talk to each other - a strategy that may be working now, but will not be fit for purpose in future as the load continues to increase. With many CMOs at a loss, GfK is seeing rising demand for its gfk-consult service. "We plough through the data and insights 24/7 and have a huge team of analytics experts who can give clients the confidence to build sound strategic plans and support their execution," says Langer.

Actionable data lays the foundation for future-proof marketing strategies that can cope with the demands of modern consumers. First, businesses need to be more selective about their insight sources to make high-velocity data marketing sustainable. "What organisations need is just a handful of relevant data sources, plus tech to help democratise and visualise it, and then skilled people who can interpret it and convert it to real-world actions," observes Gonzalo Garcia Villanueva, GfK's chief marketing officer.

According to Garcia Villanueva, optimising the speed at which data can be analysed and insights shared should be a top priority for CMOs. "When I'm looking at customer and market data and planning strategy, I want to know which campaigns and promotions are performing best and should be replicated - and where we need to stop investments right away," he says. "If you want to really capitalise on timely opportunities or hedge risks, this exercise needs to happen every week. Otherwise, you're leaving money on the table." Nearly a quarter of top data marketing performers claimed to have real-time access to customer insights, compared to just 2% of the lowest performers. Garcia Villanueva believes that 'always on' data analytics are key to driving the best value from marketing insights and achieving sustainable brand growth – essential for CMOs seeking a stronger voice in the C-suite.

Capturing up-to-the-minute intelligence from the business, its consumers, and its competitors is achievable through external tools such as gfknewron. Garcia Villanueva explains: "When you have data that shows the true sales uplift of your promotions for Black Friday and other peak seasons, you can optimise marketing strategy and future promotions to drive sustainable growth and brand premium."

To respond to insights at scale and pace, ease of use needs to be a priority. Organisations should be putting accessible structures in place that enable marketing teams to make tactical decisions quickly. But many can't afford the luxury of waiting to build those systems internally.

Time is of the essence, and Garcia Villanueva urges other CMOs to be bolder in data strategy. "If you spot the right opportunity using data from a platform like gfknewron, you've paid for your technology costs for the next three years," he says. CMOs who let their data do the work are better prepared to manage future disruptions, minimise losses, and tap into consumer purchasing habits to level up their strategies and hold that seat at the executive table.

91%

of marketers acknowledge the importance of responding to insights at speed

55%

only have slight or moderate confidence in their data analytics and insights

CMO Council, 2022

Three data mistakes CMOs should avoid

To help put chief marketers on the right path with data, Garcia Villanueva cited several critical mistakes that can prevent CMOs from climbing the high-velocity data marketing curve.

Frequency is key

One pitfall that CMOs can fall into is not looking at data often enough. Garcia Villanueva cites the example of washing machines and fridges. "We don't buy them very often – but if your fridge breaks and you need a new one, you'll have a new one within 48 hours," he says. "As a brand, if your messaging was off that week, then you've missed that opportunity and left money on the table."

When it comes to data, curate aggressively

The second concern is that CMOs are trying to process too much data. "You might have 100 or 200 potential data sources, but in reality, perhaps four of them matter," Garcia Villanueva continues. Rather than trying to pull in more data, companies should redirect their focus to identifying the most important market insights and establish systems that will make that data easy to visualise and understand.

Democratising data breaks down barriers

A major roadblock for many CMOs is that data is not being democratised. "If you have the right people and the right partners, you can democratise that data more quickly," CMOs should look to remove barriers to data sharing and decision-making in some areas, Garcia Villanueva adds: "I don't wait for the market research team to show me data when I'm making decisions. I'm going to look at leads, see which campaigns are working best, and then make choices on what I need to replicate, or change."

With these watch-outs in mind, CMOs can leverage carefully selected data and tools to keep securing loyal customers – and confirm their own roles as future-focused leaders and collaborators.

For more information, visit gfk.com/cmo

GfK Growth from Knowledge

CONTINUITY PLANNING

Five ways to build resilient data centres

Remote storage facilities are becoming increasingly vulnerable to extreme weather events. Can improving their ability to withstand such threats be achieved in an environmentally sustainable way?

Natasha Khullar Relph

On 19 July, as the UK faced record high temperatures, Google Cloud's data centres in London were experiencing cooling failures, resulting in connectivity problems and outages. Oracle's data centre was also forced into a protective shutdown, owing to what the company called the "unseasonably high temperatures".

As global temperatures continue to rise, the changing climate threatens the uninterrupted services of data centres. In a recent survey of operators by the Uptime Institute, 45% of respondents reported that they had experienced an extreme weather event that had threatened the continuous operation of their facilities. Moreover, 9% confirmed that they had suffered an outage or significant disruption as a result, which made extreme weather one of the biggest causes of service failures.

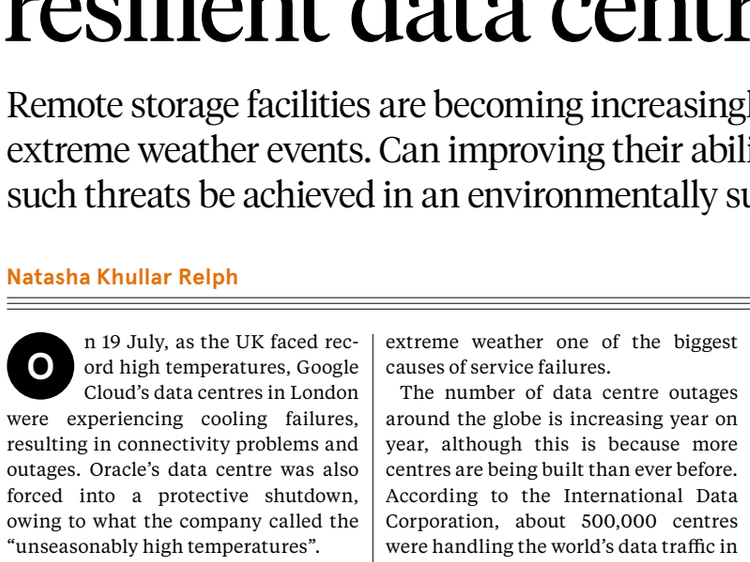
The number of data centre outages around the globe is increasing year on year, although this is because more centres are being built than ever before. According to the International Data Corporation, about 500,000 centres were handling the world's data traffic in 2012. The total in existence today is close to 8 million.

"The industry is getting much bigger and certain companies in it are becoming more powerful," observes Andy Lawrence, executive director of research at the Uptime Institute. "When they fail, more fails."

He notes that we're all becoming far more dependent on data centres. This means that, when one does fail, it has a wider-reaching impact. A quarter of respondents to the Uptime Institute's survey said that their most recent outage had cost more than $1m (£900,000) in direct and indirect costs, with a further 45% reporting that theirs had cost them between $100,000 and $1m.

Data centres are notoriously bad for the environment. They have the same-sized carbon footprint as that of the aviation industry and are set to account for 3.2% of the planet's total greenhouse gas emissions by 2025, while consuming a fifth of the world's electricity.

Consequently, efforts are focused on how data centres can meet the demands of digitisation and create infrastructure resilience, while having as little impact as possible on the environment. These are five of the most popular solutions.



1

Waste heat utilisation

Across Europe, tech companies are experimenting with waste heat recovery from their data centres. Meta has been reusing heat from its centres to warm 6,900 homes in Denmark, for instance. Microsoft, meanwhile, has powered a data centre in Finland with carbon-free energy and recycled the waste heat to nearby homes and businesses. Energy-efficiency agency Codema has partnered with an Amazon data centre in Ireland to capture waste heat for use in homes and council buildings. And in Sweden a project called Stockholm Data Parks has been running in partnership with the city's government, the local heating and cooling agency, and several data centres. The goal is to heat 10% of the capital by 2035.

"In Germany, data centres have evolved from being enemies of the state to becoming one of the heat sources," reports Stefan Mink, head of TechOps hosting at Ionos, who has been responsible for the planning, construction and management of 20 data centres in Europe and the US. "It's become a circular economy, whereby the data centres are using the energy but then also providing energy in terms of heat use."

A 2017 white paper from the Alliance for the Strengthening of Digital Infrastructures in Germany had noted that the 13 billion kilowatt-hours of electricity that was converted into heat in the nation's data centres over the year would, if reused, have met the annual energy needs of Berlin.

In 2019, investment analysis of waste heat from data centres showed that the process of reuse was a financially viable option and could provide an attractive return on investment for companies. Moreover, by helping to take pressure off the main grid, the process would eventually come back around and help to make the data centres themselves less prone to outages.

But there is still some way to go before waste heat utilisation can enter the mainstream. Most data centres still use air-based cooling. Because air isn't an efficient transport medium, consumers of the captured heat need to be located near a centre. Added to this, the infrastructure would need to be upgraded.

"Capturing and reusing heat would require a full overhaul of your entire facility, while [other options] may be less invasive to your hardware set-up," observes Daan Terpstra, executive chairman of the Sustainable Digital Infrastructure Alliance. "But, with a typical hardware refreshment cycle of data centres being somewhere between five and seven years, I think this is an ideal moment to start plotting the chart and placing this at the top of the list."

2

Liquid cooling

With the demand for data rising exponentially, data centres need a lot of energy to stay running – and cool. Specialised computing equipment can emit large amounts of heat. It's important to regulate this to keep the system functioning. Traditionally, that was achieved by creating almost sub-zero, freezer-like conditions, but in recent years the sector has learnt that data centres operate most efficiently at ambient temperatures of between 18ºC and 27ºC. As recently as five years ago, 40% of the total energy consumed by data centres was used in the cooling of equipment. That proportion has since fallen to about 10%.

Although this is the era of air-based cooling, experts agree that liquid cooling – in which heat from equipment is transferred to a liquid and siphoned away – is relatively energy-efficient.

As Lawrence points out: "Air-based cooling pushes the hot air out of the system – you exhaust it. And that is wasted energy."

As opportunities to use waste heat from data centres as an energy source proliferate, liquid cooling is set to become an increasingly important technology. Even in heavily insulated pipes, hot air can't travel very far before cooling too much. Hot liquid, on the other hand, is far more transportable.

"The other thing about direct liquid cooling is it requires very little water," Lawrence says. "It will be easy to use."

3

Artificial intelligence

Several of the world's tech giants have set ambitious renewable-energy targets for their data centres. For instance, Meta, which has more than 20 centres, committed to 100% renewable energy in 2011, followed by Apple, Google and Amazon.

Microsoft has pledged to become carbon-negative by 2030. It has also committed to removing all of the carbon the business has ever emitted, either directly or by electrical consumption, since it was founded in 1975, by 2050. A blog post on its website states: "To reach this, data centres must be part of the solution for broad decarbonisation."

Nonetheless, buying carbon offsets is the method by which many big tech companies are aiming to achieve net zero, which means that they will, in effect, still be using fossil fuels. That situation may change quickly, experts believe, partly because of societal pressure and upcoming legislation.

"Based on the current social and economic climate in continental Europe and the UK, sustainability will become a licence to operate," Terpstra says.

AI is one of the most cost-effective and scalable tools for improving the energy-efficiency of data centres. In 2018, for instance, Google and DeepMind jointly developed an AI-powered recommendation system to control the cooling of data centres, resulting in claimed average energy savings of 30%.

The use of AI can offer more than energy and cost savings. There's also resilience. Alibaba Cloud, for instance, has deployed machine-learning-based temperature alert systems in its global data centre. In July 2021, the firm's principal engineer, Wendy Zhao, told industry publication *Data Centre Dynamics:* "We took hundreds of temperature sensors' monitoring data, using an ensemble graph model to quickly and precisely identify a temperature event due to cooling facility faults. It generated alerts much further in advance and provided the data centre operation team precious time to respond to the fault."

Microsoft is developing an AI system to analyse data and generate alerts to "prevent or mitigate the impact of safety incidents", while Meta is investigating ways in which AI can anticipate how its data centres are likely to operate under "extreme environmental conditions".

4

Microgrids

Most data centres have multiple sources of power so that, if one source fails or goes down, another can keep them functioning. Resilience has always been a primary concern for data centre operators. While the threats and the solutions might be evolving, the ability of a data centre to withstand failures cost-effectively remains paramount.

Microgrids are increasingly being seen as an excellent back-up solution for data centres. A microgrid is an autonomous local energy grid that enables you to generate your electricity, which means that it isn't dependent on the traditional grid. It can not only keep the data centre's power on during grid outages; it can also store electricity and sell it back to the grid.

"So many outages are happening that any critical facility – whether it's a hospital or a data centre – is thinking about how to ensure that it's able to run if the grid goes down, not just for an hour or two but potentially for days or weeks," says Jayesh Goyal, chief revenue officer at Enchanted Rock, a company that's been contracted by Microsoft to develop California's largest microgrid. The facility will use renewable natural gas and provide Microsoft's San Jose data centre with auxiliary power.

What makes microgrids especially noteworthy, Goyal says, is that you can choose how you want to power them. Renewable, natural gas or fuel cells – the choice is yours, constrained only by cost and space. Natural gas is a popular fuel choice for microgrids because of its accessibility and relatively small environmental footprint. But what's exciting to many experts is the opportunity to use hydrogen fuel cells.

In 2020, Microsoft worked with Power Innovations to power an array of data centre servers for 48 hours using fuel cells with a first-of-its-kind hydrogen generator. Hydrogen is described as a clean fuel because water is its sole by-product. But it occurs naturally only in compound form and the cost and technology required in separating it from other elements have been prohibitive. This situation has started to change, though. As it does so, hydrogen-fuelled generators and microgrids start to look like a real possibility.

Terpstra believes that hydrogen fuel cells will need to be used in more than microgrids and back-up generators. Building a data centre fully powered by hydrogen fuel cells is the only route to cost-effectiveness, he argues.

"The calculations I've seen mean that the costs of setting up hydrogen back-ups versus the number of times you'd need them are completely out of balance," Terpstra says. "The run-time on back-ups is too little when compared with the investments required."

Underwater data centres

In 2018, Microsoft ran Project Natick, dropping a data centre containing 855 servers 35m below the sea just off the Orkney Islands. The aim was to insulate the facility from extreme temperature fluctuations and test whether underwater data centres could be reliable and practical while using energy sustainably.

Two years later, the company retrieved its data centre and found that only eight servers were down. Microsoft said that the equivalent figure on land over the same period would have been 64.

Subsea Cloud, which plans to start operating an underwater data centre off the west coast of the US before the end of this year, claims that constructing underwater data centres is cheaper and could reduce carbon emissions by 40%.

In a bid to meet their stated targets, Microsoft and other big companies are experimenting with ways to make data centres more sustainable. While this is to be lauded, many of their experiments are impractical in terms of both cost and scalability, according to Terpstra.

"It may be super-cool to have underwater data centres, but there are so many other solutions possible that would result in the same effect by looking at the reliability and climate impact from a holistic design viewpoint," he says.

For Terpstra and several other experts in this field, it's all about practical measures that can move the needle now – and will continue to create an impact as the infrastructure improves. ●

5

Decision intelligence is bringing the power of data analytics to a wider audience

Owing to advancements in artificial intelligence and machine learning, analytics is entering an era of unprecedented accessibility. Will data democratisation become the new normal?

For many organisations, data is at the centre of fundamental decision-making, providing business leaders with guidance on how and when to act. But this new emphasis on analytics may leave technical teams burdened by a backlog of additional tasks while their non-technical counterparts struggle to contribute.

As companies become more connected and data-driven, the question is no longer if data should be made available to more people in an organization – even everyone in an organization - but how.

Of the estimated 130 software offerings in the analytics and business intelligence (BI) space, few have evolved to meet the needs of modern, data-driven businesses. Where most BI products have yet to catch up, technical professionals are filling in the gaps to support line-of-business staff. A growing number of enterprises are working towards company-wide adoption to turn data into actionable insights across the board, starting with the embrace of augmented analytics tools that incorporate artificial intelligence (AI) and machine learning (ML).

Calls for continuity

The use of different BI and analytics tools by different teams and departments has created a complex IT landscape that often obscures trends and insights instead of revealing them: silos, shortcuts and inconsistent KPI reporting abound. This lack of continuity makes it difficult for business leaders to accurately anticipate trends or disruptions, and the steps they need to take to course correct or capitalise on opportunities.

"You have a single CRM solution for everybody in the company to manage customer relationships," says Omri Kohl, co-founder and CEO of Pyramid Analytics. "You have a single ERP to manage your financial - and potentially your production - environment. But you sometimes have hundreds of localised ad-hoc analytics initiatives, so you end up with lots of siloed implementations that advance a specific function but don't provide a view of the entire company."

> **If I'm a manager of a group of people and I don't make data-driven decisions, my team won't make data-driven decisions**

These siloed implementations have occurred against a backdrop of explosive data growth. A decade ago, businesses had limited access to data and accurate, accessible insights that analytics provides. Today, data is abundant, whether structured or unstructured, in small, independent data sets or large inflows of insights that talk to one another. The value is in how information powers decision-making across the business.

This vast wealth of data is constantly in motion. "Data used to be stuck in an enterprise data warehouse," says Kohl. "Now it's moving to data lakes. It's moving from on-prem to the cloud. It's moving from cloud to multi-cloud, and so forth." Keeping up with this sustained movement is a challenge and business intelligence needs to adapt to support new levels of operational flexibility.

Democratising decision-making

Navigating this complex data environment and using insights to drive smarter business decisions requires clear leadership. "If I'm a manager of a group of people and I don't make data-driven decisions, my team won't make data-driven decisions," says Kohl. But all too often, managers who want to apply data to make smarter decisions are faced with a debilitating lack of technical know-how.

Department heads want to analyse data in a way that enables them to detangle functional insights from assumptions and use these insights to report with confidence to the executive leadership team. To achieve this independently, they need access to nuggets of information that can inform timely, intelligent decisions.

However, many analytics and BI tools are still targeted at the needs of technical users rather than the needs of the business itself. They require extensive training and skill to use, which makes them inaccessible to the everyday line-of-business user. If a manager wants to understand why a certain area of the business is performing in a certain way, they need to call in the BI experts. And the result is slow – or even no – decision-making.

The Pyramid Analytics Decision Intelligence Platform is a prime example of a streamlined, unified and personalised decision intelligence platform that allows non-technical employees to access and analyse multiple data sources in an AI-driven no-code environment. "Everything is drag and drop and point and click," Kohl explains. "You don't need to know how to write code... [but] you can still do very deep, very sophisticated research on your data." Increasing the availability of analytics and creating greater overall visibility means anyone can draw valuable insights from data flowing into the business quickly, without relying on hypothetical assumptions.

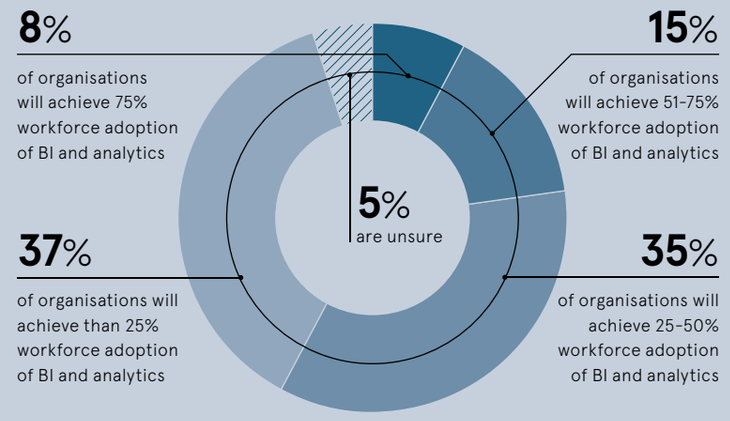
Going one step further, prescriptive analytics uses AI to offer actionable recommendations based on insights and trends, as opposed to speculation. The outcomes can be tangibly financial, organisational, and even environmental. A power plant, for example, could determine what mix of energy sources they should be using to maximise efficiency and minimise their carbon emissions, without bringing in analytics experts.

Personalised experiences

Data is integral to almost every business function, so finding a more accessible way of interacting with analytics is key to developing a healthy data culture across teams. The onus is on business intelligence and analytics tools to meet organisations where they are.

IN MORE THAN HALF OF ORGANISATIONS, THE MAJORITY OF THE WORKFORCE WILL NOT BE USING USING ANALYTICS AND BUSINESS INTELLIGENCE TO OPTIMISE THEIR ROLES BY 2024

Projected data and analytics adoption rates



Ventana Research, 2022

Non-technical users who are uncomfortable using even basic point-and-click and drag-and-drop BI tools can still intuitively interact with data visualisations using plain English, via a Natural Language Query (NLQ) chatbot. Pyramid's NLQ chatbot, for instance, allows users to type or use voice commands to query data natively and directly in the data source, regardless of location, size or complexity. This means anyone in the business can fully investigate data without needing to know the underlying data structures, hierarchies and measures, with the platform generating actionable insights that can then be shared in a report or presentation.

"If you see an underperforming salesperson...you can start asking 'is it the product that he's selling? Is it his territory? Is it the demand generation engine behind him? Is the cost of the solution that he's selling too expensive based on the competition?' You can start peeling the onion, even as a non-technical user, and go very deep," Kohl explains.

AI and ML can tailor the analytics environment to an individual, ultimately generating more data-driven decision-making. "It could be automated insights that we push to your morning dashboard: 'here are the five things you need to know about your business that happened in the last week'," Kohl explains.

Democratisation is a win-win. Reducing one-off requests means freeing up data analysts to focus on more strategic work. Instead of providing reports and dashboards, they are empowered to provide predictive and prescriptive insights that allow them to identify core business strengths and double down in those areas.

For this to work, companies need to develop a lateral approach to analytics, equipped with intelligent tools that bring new voices into the conversation.

To learn more about applying augmented analytics, decision intelligence and AI in your enterprise, visit pyramidanalytics.com/decision-intelligence-platform

pyramid

Q&A

Pioneering inclusive artificial intelligence

Gauthier Vasseur is executive director of the Fisher Center for Business Analytics at the University of California, Berkeley, Haas School of Business and co-president of the Alliance for Inclusive Artificial Intelligence (AIAI)

AIAI's core mission is to inspire and empower women, underrepresented minorities, and people from lower socio-economic backgrounds to successfully pursue an education and career in analytics. The Pyramid Decision Intelligence Platform supports Vasseur's 'Step Into Data' workshops, which have provided more than 2,000 learners in 30 countries with hands-on experience in data analytics.

Q What has traditionally limited access to AI, analytics and data-driven insights?

A It's easy to use our gut feelings, to keep going with our own biases. But as soon as you become data-driven, your biases are exposed and that's not something we naturally want. It forces us to change; it forces us to be humble, and that's not always easy.

Secondly, good, qualitative data – data that is prepared, curated and ready for analysis – is much scarcer than you might think. A lot of people say, 'I'd love to have more insight', but then they get their hands on some data and it's a mess. You're not going to get much from data that is just raw, that is not indexed, or that is not linked.

Thirdly, there is still a belief that data analytics means data science and coding, so it is 'not for me'. What's changing these days is that we have low-code, no-code approaches. This empowers you to do the same thing you would do with coding much more easily and to some extent, much faster. But even better, it makes [data analytics] more accessible.

Q Why was the AIAI established and what do you hope it will achieve?

A Our mission is not only to promote research and awareness; it's also to promote the application and the impact of business analytics. That application and impact only happen if anyone can do it.

We realised that in today's world, unfortunately, women and underserved communities don't have access [to business analytics]. We will never have good quality, sustainable, humane, ethical analytics if diversity of profiles aren't included and if it fails to represent the whole world. So, the AIAI was born from that.

Companies, administrations, and governments need to train their people. So, our proposal is: train your people with us and for each person who trains, we will offer one free Berkeley Extension business analytics certificate for a woman or [member of an] underserved community. This leads to something quite self-fulfilling. As you struggle to recruit the right people, guess what? We have certified women and [people from] underserved communities who will follow the same workshops as your employees and will know exactly how to work with you.

> **Good, qualitative data – data that is prepared, curated and ready for analysis – is much scarcer than you might think**

Q What has your partnership with Pyramid Analytics brought to the AIAI?

A The partnership with Pyramid has been fantastic from the get-go. Even when we were just starting out there was full trust: we understand what you do, and we are going to help you. That is not common.

Communities that have been left behind need to catch up, they need to be operational, and they need to find a job. So, all our classes are designed to be hands-on: I learn, I do, I learn, I do. And that's why we work with Pyramid Analytics, because it's fantastic for learning everything about a data process and then applying it right away in a no-code environment.

It's a tool which allows any student, anywhere in the world, on any machine, to run world-class analytics without having to go through a tedious install process, [access] powerful machines, you name it. The feedback we get is that they can't believe they can do all this. They feel empowered, and that's a game changer.

Q How can greater access to data analytics bring about positive change in the world?

A Your mindset radically changes once you dare to acknowledge a problem because you're empowered to ask the right questions. You can't do magic. But if there is a solution and you have the data, you feel empowered to find it. That's the level of confidence we give to women, underserved communities, and all our professional trainees.

PUBLIC SECTOR

Partners against cybercrime

Senior public sector cybersecurity specialists are moving into the private sector in growing numbers. Could this trend provide the groundwork for a more unified approach to data protection?

Christine Horton

Data protection is a growing concern among organisations around the world, yet there is a general shortage of cybersecurity skills at all levels. At the same time, cyber experts from the higher echelons of government and other public sector bodies are moving into the private sector in their droves.

In the US, for instance, the CIA's former chief information security officer, Michael Mestrovich, recently called time on more than two decades of public service to join cybersecurity firm Rubrik as its CISO. He was followed by Chris Krebs, the former director of the Cybersecurity and Infrastructure Security Agency (CISA), who became chair of Rubrik's CISO advisory board.

"Cybersecurity is not a level playing field," Mestrovich says. "It can be a challenge when resources and expertise are limited, particularly in local government. We must explore how governments can pool their resources to provide cybersecurity as a service, as opposed to forcing each IT service provider to compete for this already scarce talent."

It isn't only top-level security specialists in the US public sector who have been quitting for jobs in business. Tim Ward's long career in cybersecurity has straddled both sectors in the UK. The former global head of information services at BAE Systems Digital Intelligence and chief architect for shared digital services at the London Borough of Camden, he is now co-founder and CEO of the Think Cyber Security consultancy.

Ward says that the move of experts from public to private sector isn't necessarily a response to any government initiative.

"It's the obvious 'retirement plan' that the public sector individual can open doors for the private firms. This has been taking place in the defence market for years," he explains.

Mestrovich reports that plans are under way in the UK to address its shortage of cybersecurity expertise. "The UK Cyber Security Council has made positive moves to address the nation's cybersecurity skills gap by engaging with a broad range of industry stakeholders and promoting investment and training. This is certainly a step in the right direction," he says.

One of the founders of the UK Cyber Security Council, Jessica Figueras, points out that the public sector is often a less attractive career option for technologists, particularly those specialising in cybersecurity, "just because the pay is so much worse. The UK public sector is struggling for full resources at all levels of cybersecurity. This does tend to affect more strategic levels in particular. It means that senior cyber roles – in both the public and private sectors – tend to suffer a lot of churn."

There is some good news in this area. The government's National Cyber Security Centre (NCSC) offers advice and support for public and private sector organisations on how to defend their systems. Ward points to the fact that the centre has reinvigorated its startup accelerator as NCSC for Startups and is working with a new cohort of companies.

"This is as close as the NCSC comes to saying it thinks a technology company is on to a good thing, offering both commercial and technical support," he says. "It's a break from the usual NCSC role of offering advice to help private sector organisations create solutions that will serve both the public and private sectors."

Elsewhere, a new project is drawing on the expertise found in small and medium-sized enterprises and academia rather than turning to the big four consultancies. The Reducing Public Sector Risk Through Culture Change project has been offering SMEs unprecedented access to government departments to explore the challenges and design prototype solutions.

"The project's outcomes could reduce duplication and other inefficiencies across government," Ward says, but he adds that "phase two has been an unfortunate victim of government spending cuts, despite its potential for cost reduction".

Nonetheless, there are opportunities where the public sector can support the development of a unified approach. These could include working in partnership to input ideas early in their creation, through NCSC for Startups and schemes such as Innovate UK, Tech Nation and techUK, and then allowing SMEs to contribute.

"There is", Ward says, "a strong sense in the commercial cyber industry, especially among SMEs and startups, that the best way for government to support the development of best practices and good tools is – at the very least – to curate groups of firms that it believes are doing good things in the space and to guide them. And even better, for government to buy those very tools from the innovating companies."

Is the vision of the world's public and private sectors working together to help protect the world's data a viable one? Mestrovich certainly thinks so.

"We are seeing increased collaboration between the sectors on cybersecurity in the US," he reports. "Organisations such as the CISA and law enforcement agencies are coming together and developing a framework to prevent, and respond to, attacks. They're building a prescriptive playbook that uses cross-sector expertise for IT professionals to take off the shelf and implement. There are also opportunities for local governments to set up cybersecurity and threat intelligence services to create cybersecurity as a service that local IT service providers can use. This is about pooling resources and bringing the best levels of expertise to the challenge."

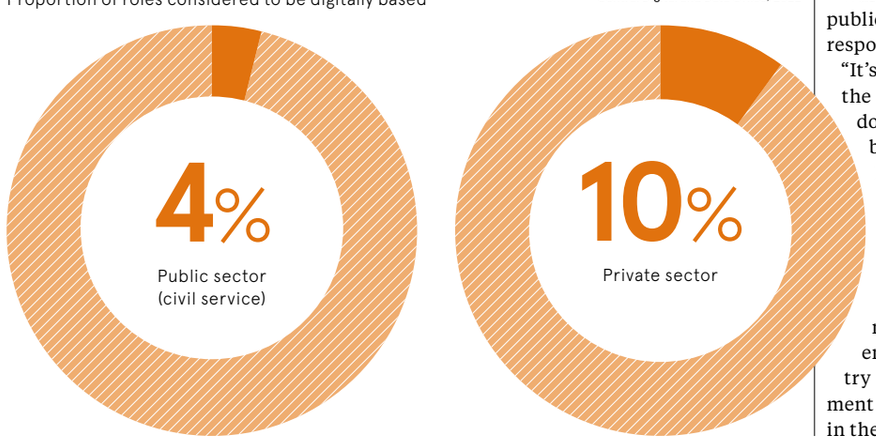
Mestrovich believes that inter-sector cooperation will be key to the success of future security efforts. "Every organisation should be enabled to use the best information to inform their cyber resilience strategies," he says. "We must share best practice, threat intelligence, training resources and lessons from the lived experiences of attacks to meet the cyber challenges facing our most important infrastructure and services."

PeopleImages via IStock

THE UK'S INTER-SECTOR SKILLS GAP

Proportion of roles considered to be digitally based

Central Digital and Data Office, 2022



3,867

The number of vacancies for data and tech roles in the UK civil service in October 2022

Central Digital and Data Office, 2022

> **We must explore how governments can pool their resources to provide cybersecurity as a service, as opposed to forcing each IT service provider to compete for this already scarce talent**