



# building an AI strategy:

## telcos put the foundations in place

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# the big picture

The AI journey started in 2016 or 2017 for some of the more progressive, ambitious operators, and in 2019 or 2020 for most others. But it is only in the past 12-15 months with the explosion of interest in Generative AI (GenAI) that it has become a key focus for most boardrooms and the technology which communications service providers (CSPs) are pinning their hopes on to transform their financial fortunes.

The purpose of this report is to understand where CSPs are on their AI journeys. It is based on briefings with AI decision-makers in 20 of the world's largest and leading CSPs globally. We believe they represent some of the more progressive CSPs in terms of their investment in, and commitment to, AI technologies. As such, they present a slightly distorted picture of the global status of CSP use of AI. However, the challenges and opportunities they speak about in relation to AI are common to the sector as a whole.

We also publish the results of a survey in this research in the form of charts throughout the report. The survey – which we also used for an earlier report, [Generative AI: operators take their first steps](#) – covers a broader cross-section of CSPs, with responses from 104 executives across 73 CSPs globally.

Two of the 20 operators that we interviewed – China Mobile and SK Telecom – are building AI businesses with a clear objective to monetize their investments. The other 18 are investing in AI for their own internal usage, principally to drive efficiencies and improve customer experience. Addressing the growing complexity of their businesses – and specifically their network operations functions – is also a key driver.

All the operators that we spoke to are ramping up their investments in AI – be it building teams of AI experts or building platforms and tools in readiness to start scaling AI deployments.

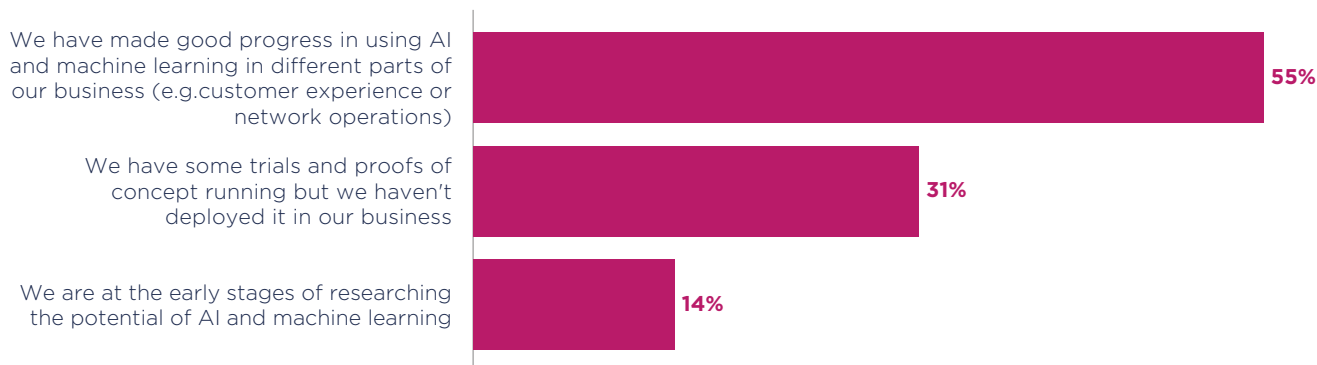
“I’d say every meeting I go to, nearly without exception, there’s some component that discusses what we’re doing in AI – next year’s investment planning, execution skills, people development,

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**I’d say every meeting I go to, nearly without exception, there’s some component that discusses what we’re doing in AI – next year’s investment planning, execution skills, people development, everything.”**

**Mark Sanders,**  
Chief Architect, Telstra

## How effectively is your organization exploiting AI and machine learning?



TM Forum, 2023

everything,” says Mark Sanders, Chief Architect, Telstra.

However, it is important to draw a distinction between “traditional” types of AI – what we refer to in this research as predictive AI – and GenAI.

CSP investment in predictive AI has, until now, been relatively modest. Most operators have deployed a handful of use cases in areas such as energy saving, churn prediction, and next best action which uses AI and real-time data to target customer experiences. But they have lacked the skills, the tools and compelling evidence of good returns on investment to scale rollout. Furthermore, use cases have been more “bolt-on”, rather ones that sit within an overarching architecture or operating model.

### The focus on GenAI

Over the past year to 15 months CSPs’ AI strategies have pivoted to focus on GenAI. Indeed, in many of our conversations for this report GenAI was the main topic of discussion. Most CSPs have drawn up well in excess of 100 use cases and are engaged in a process of aggressive experimentation. But very few have been put into production.

We expect this to change during 2024 and, more likely, in 2025.

Somewhat ironically, this enthusiasm for GenAI may end up boosting interest in predictive AI. While some use cases involve only GenAI, many others require the two to be used in tandem. Furthermore, when it comes to using AI for automation GenAI has its limitations, particularly in the network and the drive towards autonomous networks.

In speaking to CSPs about the status of their AI journeys most conversations tend to end up focusing more on GenAI than predictive AI. Is this because CSPs believe there is far more potential than in machine learning and predictive AI? Or is it just because GenAI is the newer technology and has captured the imagination of boardrooms and their advisers?

A key reason for GenAI’s appeal is its accessibility compared with machine learning and predictive AI, and the fact that it uses the same inputs and provides the same outputs as the tools we use in our everyday working lives. GenAI can take our conversations, the emails we write, the documents we use, the online research that we conduct and the presentations we make and add value to them.

What’s more, at a time when every person in the CSP organization is encouraged to be more customer centric, GenAI offers the promise of delivering insights and value from the millions of conversations and messages that pass between customers, customer service agents and online and mobile platforms. Even the least technology-savvy people in an organization can get their heads around what GenAI can do.

### A realistic assessment

AI is neither, on the one hand, the answer to the challenges that CSPs face nor, on the other, a wildly overhyped technology that will fail to have a meaningful impact on operator organizations. AI will be adopted by operators in the same way that it will be adopted by almost every other sector. But will it enable CSPs to significantly cut costs, to create new products, services and revenue streams, and to redefine the relationship with their customers?

The cost discussion is, perhaps, the most interesting one, and lessons should be learned from the experience of public cloud which was originally touted as a cost-saving opportunity for CSPs. Operators are under pressure to cut their costs because of revenue

stagnation. In many cases AI-enabled automation can help employees do their current jobs more efficiently and more quickly.

But will operators be able to capture these time savings and convert them into the elimination of different roles? Or will it simply allow employees to focus their time on other tasks and functions that create more value? Ultimately, this will come down to departmental budgeting, the pressure to reduce capex and opex, and whether AI and automation are two of the tools that CSPs lean on to cut costs.

We should also not forget that AI will require operators to invest in new roles, new technologies and platforms and, in some cases, new infrastructure. In addition, as we see in section 2, new skills tend to be more costly than old ones.

Below are some of the key findings and recommendations from our research. For a fuller summary see section 9.

## Key findings

- There is nearly universal recognition that **AI will lead to a paradigm shift in CSPs' operating models**. However, very few operators have a clear picture of what that operating model will or should be.
- AI-ready access to **clean, quality, usable data is the single biggest challenge to the deployment of AI at scale**.
- **Most AI deployments today are "bolt-on" use cases** – specific, isolated deployments rather than ones that represent part of an overall architecture and operating model.

- There are few examples today of AI use cases / deployments that have delivered significant or clearly demonstrable value to the CSP business. **Those areas where CSPs have had early success include energy saving, network planning / [smart capex](#) and churn prediction models.**
- Despite the buzz around GenAI very few use cases have been put into production. Many **CSPs are hoping that 2024 will be the year GenAI-enabled use cases become a reality.**
- **Future predictive AI uses cases are increasingly seen as principally delivering value to network operations** as CSPs seek to build autonomous networks.
- **GenAI is most likely to see wide-scale deployment in customer-facing functions and as a tool for driving greater productivity** generally.
- Operator spending on AI (as opposed to analytics) has been modest until now, but **many CSPs are starting to spend significantly more on hyperscaler services that embed GenAI.**
- As they embrace GenAI **CSPs are becoming increasingly reliant on hyperscale service providers and the public cloud.**
- **Very few operators are building AI infrastructure. Rather, CSP investments are focused on developing use cases and building platforms** for teams across the business to use different AI tools.
- Our analysis of CSP capex and opex presents two scenarios for the potential savings that

could result from the successful use and deployment of AI.

**In a "bullish" scenario total capex and opex for telecoms operators globally falls by 9.1% from \$1.8 trillion to \$1.64 trillion. A "bearish" scenario sees a 2% decline to \$1.77 trillion.**

## Recommendations

- Operators need to **develop easy access to data that sits across the entire organization if they are going to deploy AI at scale.**
- If operators are to shape how AI will change their businesses **they must fundamentally embrace these new technologies and make them integral to their operations.** If they do not, they risk being locked into technology choices and architectures.
- CSPs must not repeat the mistakes they made in public cloud where many tried to compete with hyperscaler service providers. Their **focus in AI should be on the deployment of use cases and the creation of platforms for delivering AI capabilities to their internal organization.**
- For operators to deploy AI at scale and to industrialize deployments they need to **embrace machine learning operations (MLOps) and FinOps** in the same way that the software sector was transformed with the use of DevOps.

In the first section we look at the different approaches CSPs are taking to build organizations able to harness AI technologies.

## section 1:

# building an AI-ready organization

Finding the right balance between creating central functions and capabilities on the one hand, and democratizing access to AI tools on the other, is a major challenge for CSPs. As a result a variety of roles, organizational alignments and governance functions are being developed to get this balance right.

Operators had been building and evolving their data analytics organizations for several years before AI emerged as a strategic priority. AI functions and organizations tend to sit on top of these data analytics teams – although in some cases they are part of the same team – and their size and remit tends to be a function of how much AI technology an operator is building and what, and how much, it is buying.

Any future organizational function and structure needs to factor in the following considerations:

- AI is a tool for innovation, and anyone in the organization can potentially be an innovator. As such, **AI needs to be made available to every team in the company.**
- The level of comfort with embracing new technologies varies enormously. **Every effort needs to be made to make AI easy to use**, even for teams with low technology capabilities.
- Reusing successful use cases can be a major challenge. **The central AI team / platform needs to be able to see where successful use cases are being rolled out** and facilitate their reuse across the organization.
- Cost management risks become a serious issue if the democratization of access to AI is not accompanied by **the deployment of new [FinOps practices](#) for AI.**
- There is a risk of incurring technical debt through the uncontrolled purchase and deployment of different AI models and services across the organization. **An AI governance program needs to be put into place** to reduce the risk of incurring debt while, at the same time, encouraging usage and experimentation.

In this section we look at some examples, from our research, of the different organizational approaches that CSPs are taking to harness AI.

## Creating a CXO role for AI.

As the profile of AI, and the expectations for what it can deliver, have risen it has become increasingly important that there is expertise and representation at – or just below – board level. Two of the CSPs that we spoke to for this report have appointed Chief AI Officers (CAIOs). Steve Jarrett,

previously Group Senior Vice President, Data and AI, at Orange Innovation, was appointed Chief AI Officer of the French operator in December 2023. In his LinkedIn profile Jarrett says his team “leads our ‘Data Democracy’ cultural and technical transformation of the company”. In his role Jarrett also leads the selection of key partners and the identification of potential acquisitions.

BT has a Chief Data and AI Officer – Deepika Adusumilli – who joined the company in October 2023. Adusumilli reports to Harmeen Mehta, Chief Digital and Information Officer.

While a CAIO is responsible for AI, a Chief Digital Officer (CDO) looks after all “digital” technologies. In CSPs this tends not to include the network itself which is the responsibility of a Chief Technology Officer or a Chief Network Officer.

SK Telecom is another CSP with a high-profile AI role. Chung Suk-guen is Chief Global AI Officer at SK Telecom, but his role is principally focused on GenAI and building products that can be leveraged internally and monetized through partnerships with other CSPs and, potentially, software and services vendors.

Rather than having a single CXO responsible for AI, some CSPs divide responsibilities between executives. African telecoms group MTN has an AI steering committee co-chaired by the Group CIO and Chief Strategy and Transformation Officer, Chika Ekeji.

Chief Data Officer is also a role which exists within many CSP organizations. Perhaps the highest-profile Chief Data Officer in telecoms was Chema Alonso at Telefónica, although he has now transitioned to Chief Digital Officer with responsibility for AI in customer solutions. Telefónica still has a Chief Data Officer, but this is now an internal role, with



**China Mobile and SK Telecom are investing aggressively in AI to deliver new products and services.**

responsibility, for example, for the company’s data architecture.

**Setting up a subsidiary organization to develop AI.** Many CSPs have set up subsidiaries in recent years to build capabilities, products and services in new tech and digital business areas. But these have focused on building new products, services and revenue streams rather than delivering capabilities back into the organization.

Proximus Ada is an affiliate of Belgian telecoms operator Proximus that is specifically focused on developing cybersecurity and AI capabilities. Its work is split between meeting internal Proximus requirements and delivering services to B2B customers. Proximus Chief Digital Information Officer (CDIO), Antonietta Mastroianni, says Ada was created to help find the requisite skills in cybersecurity and AI and to build a flexible organizational culture that was different from the core business.

**Splitting the internal and customer-facing AI functions.**

Rather than building a central AI organization, Telefónica has decided to split responsibilities into two: customer insights and innovation; and network, IT and internal AI-driven transformation.

Chief Digital Officer, Chema Alonso, [who created the voice-controlled AI platform Aura in 2017](#), is responsible for customer insights, while Juan Manuel Caro Bernat is Director of Autonomous Networks, responsible for managing the whole lifecycle of networks and AI.

This splitting of responsibilities is particularly interesting given that the focus of GenAI is more towards customer-facing rather than network functions, while predictive AI is increasingly a technology used for network automation.

**AI as a new business function.**

China Mobile and SK Telecom are investing aggressively in AI to deliver new products and services. The focus for both operators is building their own Large Language Models (LLMs) – and solutions and capabilities that sit on top of them – and selling access to them to enterprises and other CSPs.

China Mobile’s [Jiutian business](#) has been set up both to provide services internally to the organization and to deliver B2B services. In October the operator announced a Jiutian GenAI model which it says has “won support” from large enterprises including China Ocean Shipping and China Railway Construction Co. The model has trained more than 2 million tokens – a basic unit of text or code that an LLM uses to process and generate language – and has “knowledge” in eight industries including telecoms, energy, and steel and transport, says China Mobile.

“We believe that external success is the real measure of success [of Jiutian],” a China Mobile spokesperson told TM Forum.

**Establishing an AI center of excellence.** In our survey 53% of CSPs said they had established a center of excellence for AI (see chart on the next page). But the precise size, shape and role of these varies considerably.

How are you approaching the GenAI opportunity (choose all that apply)?



TM Forum, 2023

Dutch telco Vodafone Ziggo, for example, has an AI center of excellence which includes the company's data science team. Telefónica, meanwhile, has a global centre of excellence within its networks and IT group function that is responsible for data and AI architectures, for the migration towards a common data model, and for researching AI technologies and solutions. And Middle East telecoms group e& has a federated center of excellence with each of the key departments / functions having a representative. An AI governance function sits on top of this with a mission to ensure that use cases are reused across different divisions.

**AI as a platform function.** Some operators have built – or are building – platforms designed to make AI accessible to different parts of the organization. In the case of GenAI, for example, a platform may sit above the one, or many, LLMs that the CSP is using to ensure that the best one – in terms of cost, accuracy and so on – is used for a specific requirement. For example, Vodafone has an AI platform which also provides self-service tools and educational materials for different teams to build their own use cases. SK Telecom has what it calls an Intelligence Platform through

which the entire organization gains access to the LLM it is developing. The platform captures all the data about how the LLM is being used, the applications and the inputs and outputs, and this is then fed back into the model to help train it to become more accurate.

The process of bringing individuals and functions together to help drive better use of AI is having the added benefit of helping to break down divisional siloes. It has the potential to help empower the IT function and demonstrate its value as a driver for business improvement by interpreting and showcasing data garnered from across the organization, particularly when data from one department or function is blended with data from another. In our survey, 53% of respondents said they have different functions and departments experimenting with GenAI across the organization (see chart).

AI governance imperatives

Many of the governance requirements for AI sit within an existing data governance program. However, additional AI-specific guardrails are needed to ensure that AI tools and systems are, and remain, safe and ethical. With GenAI technology developing so

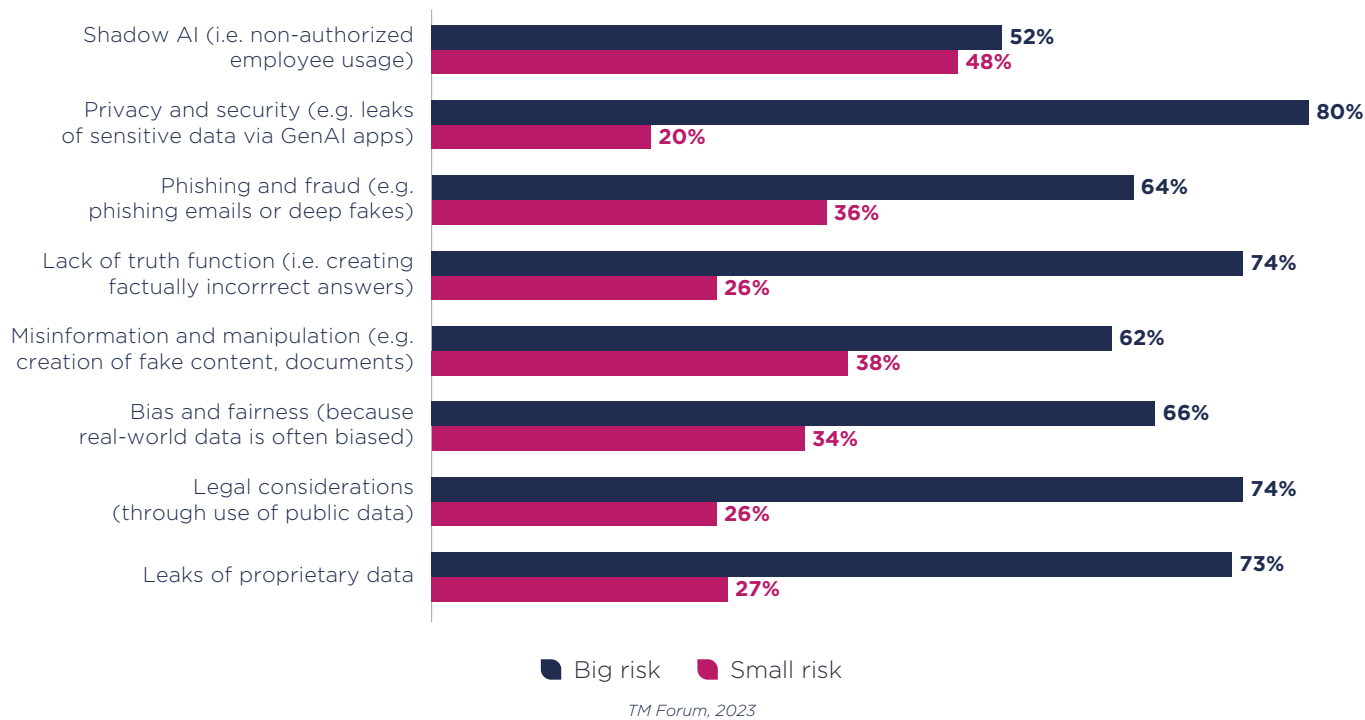
quickly the challenge is putting in place governance that remains relevant in the medium-to-long term and can be revised as new issues emerge.

There are two types, or categories, of governance programs:

- An external governance program that is designed to protect individuals and organizations outside the company
- An internal governance program designed to protect employees and to ensure that AI is deployed successfully and sustainably across the business.

Governance programs to protect people and organizations outside the company tend to be a function of government laws and frameworks. For example, the European Union [passed an AI Act](#) in December 2023, to come into effect in 2025 (see box on p.12). And in the US, President Biden issued an [Executive Order](#) on AI in October 2023. Both initiatives focus on protecting individuals, societies and businesses from potentially harmful applications of AI, but the US Executive Order also explores approaches required to ensure that the country leads the development and exploitation of AI.

## What are the main risks for your organization of using GenAI?



Our briefings found little evidence of concern that CSPs and organizations are failing to do enough, or to act quickly enough, to ensure they do not fall foul of current or future regulation. However, that may be a function of the executives who briefed us for the research. They tend to

be advocates – individuals who most likely see governance as a hindrance and a frustration. If we had spoken solely to individuals responsible for security or privacy we might have gained a different impression.

As the CDIO of one European telco, in relation to AI governance, told us: “Sometimes I feel like they are slowing me down. I understand it’s a good thing. But I feel like it’s too much.”

Strict governance programs can actually help CSPs to develop technologies and capabilities that they can monetize externally. This is particularly the case when countries have strict rules around data sovereignty. China Mobile reckons that the approaches it is taking to meet AI laws may help it to develop security technologies that it can provide to its own customers.

Switzerland is another country with strict laws around data sovereignty. There, incumbent

operator Swisscom is experimenting with building its own AI infrastructure and developing internal expertise which it can use to deliver new value and solutions in its IT services business.

The arrival of GenAI is also driving the requirement to improve internal AI governance:

- to help drive scale
- to help manage costs
- to protect the organization from the consequences of using results that are not accurate
- to reduce the risk of technical debt
- to guard against the risk of LLM training model data being “corrupted”
- to protect the organization against IP / copyright infringement.

Our survey found that privacy and security breaches represented the

“

**Sometimes I feel like [governance is] slowing me down. I understand it’s a good thing. But I feel like it’s too much.”**

**CDIO of a European operator**

main risk of using GenAI followed by “Lack of truth” (in other words, accuracy), legal considerations and leaks of proprietary data (see chart on the previous page).

Managing the uncontrolled use of AI tools represents a conundrum for CSPs and – in particular – for the CIO function. Most CIOs recognise that different AI tools and services are being procured, and deployed, across the company in an uncontrolled, uncoordinated way. On the one hand this meets a corporate goal of using GenAI to drive innovation and to experiment aggressively and rapidly. But such a scenario carries risks in terms of spiralling

costs, the potential for technical debt and a wasted opportunity to feed internal usage data back into the organization as training materials to improve accuracy.

SK Telecom is a specific case, because it is building its own LLM and needs to learn about usage across the organization in order to improve accuracy.

“Every development team in my company and in SK Group has the opportunity to use our Intelligence Platform,” says SK Telecom’s Chung Suk-guen.

In the next section we look at how operators are acquiring skills and reskilling for an AI future.



**Every development team in my company and in SK Group has the opportunity to use our Intelligence Platform.”**

**Chung Suk-guen, Chief Global AI Officer, SK Telecom**

### Europe moves closer to setting AI governance rules

In March the European Parliament [approved the Artificial Intelligence Act](#), designed to ensure safety and compliance in the use of AI. In essence it sets out to ensure that users can trust that the AI tools they access are safe to use. The act now requires the formal approval of ministers from EU member states, and other countries will be watching to see what happens in the EU before committing to their own acts.

The regulation establishes obligations for AI based on its potential risks and level of impact. It bans systems that pose an “unacceptable risk”, but exempts AI tools designed for military, defence or national security use.

Among the AI applications that threaten citizens’ rights and will be banned, include biometric categorization systems based on sensitive characteristics, and untargeted scraping of facial images from the internet or CCTV footage to create facial recognition

databases. Also forbidden are motion recognition in the workplace and schools, social scoring, predictive policing, and AI that manipulates human behavior or exploits people’s vulnerabilities.

Obligations will also be introduced for other AI systems deemed to be “high risk”. Examples include critical infrastructure, education and vocational training, employment, essential private and public services – such as healthcare and banking – certain systems in law enforcement, migration and border management, and justice and democratic processes (e.g. influencing elections). Such systems must “assess and reduce risks, maintain use logs, be transparent and accurate, and ensure human oversight”.

When it comes to GenAI – included in the category “General-purpose AI (GPAI) systems and the GPAI models they are based on” – all model developers will

need to comply with EU copyright law and provide detailed summaries of the content used to train the model. Tougher requirements will be imposed on models that pose a “systemic risk”, expected to include chatbots and image generators. The EU says requirements will include “performing model evaluations, assessing and mitigating systemic risks, and reporting on incidents”.

Fines for non-compliance will range from €7.5 million or 1.5% of a company’s total worldwide turnover – whichever is higher – for giving incorrect information to regulators; to €15 million or 3% of worldwide turnover for breaching certain provisions of the act, such as transparency obligations; to €35 million or 7% of turnover, for deploying or developing banned AI tools. There will also be a new European AI office that will set standards and be the main oversight body for GPAI models.

## section 2:

# putting the right skills in place

In the search for AI skills, most CSPs are at a disadvantage compared to tech companies, particularly when seeking to hire younger talent. Tech companies typically offer better salaries, faster career progression and a corporate culture that is significantly more agile.

Preliminary results from a TM Forum survey of CSPs, which asks about skills and culture, show that skills in AI / machine learning, data analytics and automation are in high demand. Only cybersecurity scores higher than AI when it comes to both demand for, and difficulty in finding the appropriate, skills. The graphics below and on the next page are a sampling of the survey

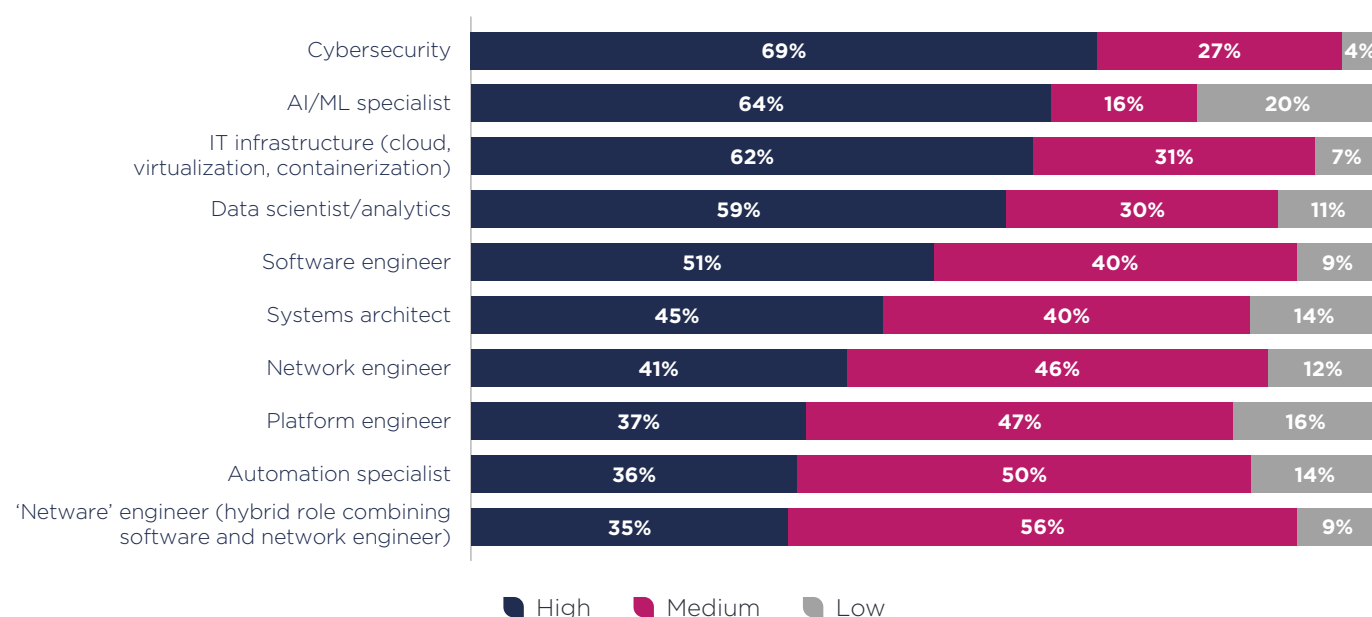
results; full, updated results will be published in an upcoming report.

### Insourcing and outsourcing

Some CSPs and alliances are developing their own AI platforms, so they need AI architects, engineers, developers and researchers. For example, [at Mobile World Congress in February](#) Softbank joined

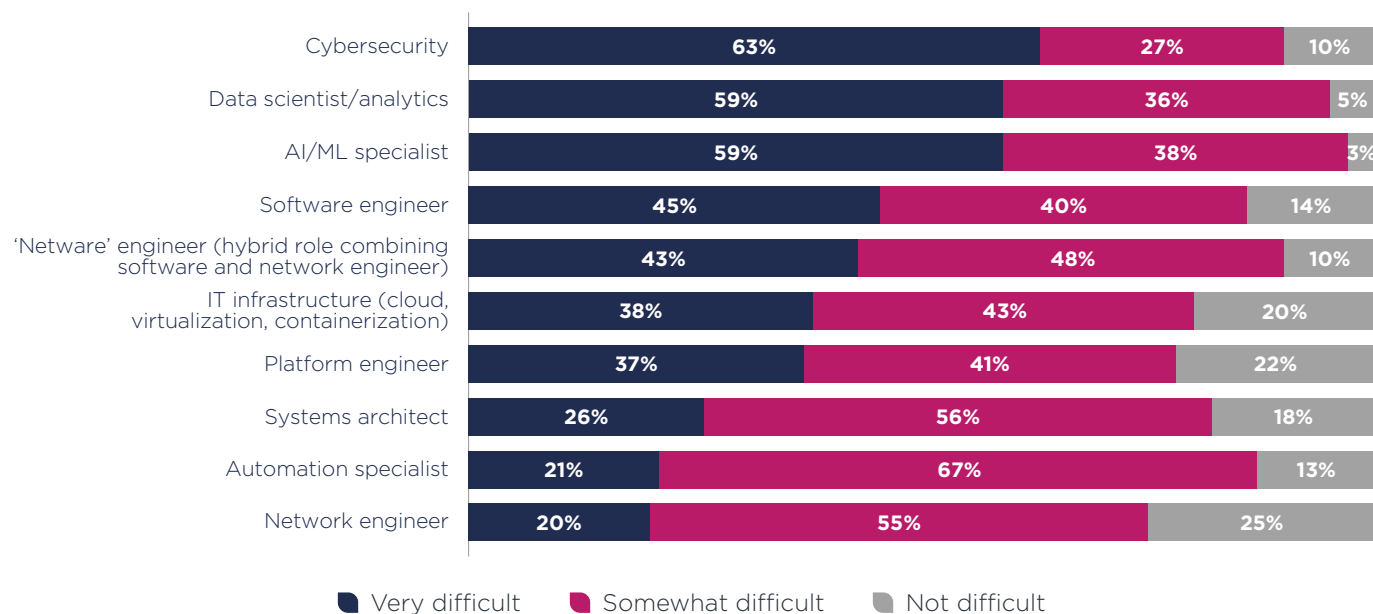
Deutsche Telekom, e&, Singtel and SK Telekom in the Global Telco AI Alliance, which was set up in July 2023 to develop telco-specific GenAI LLMs. The initiative is now being turned into a joint venture in which each of the partners will invest. China Mobile is also developing its own AI systems including an LLM (see sidebar on p.16).

## Demand for skills within CSP organizations



TM Forum, 2024

## CSPs' difficulty finding skills



TM Forum, 2024

Also at MWC, Korea Telecom announced it will recruit up to 1,000 AI and digital experts this year in its quest to become an AICT – AI and ICT – company. The operator says it will “completely change KT’s DNA to centre on AI by strengthening internal education and internalising AI”.

Other operators like Vodafone are partnering with hyperscalers for AI platforms, but they still need skills in AI operations (AIOps) as well as analytics, automation, cloud and platforms. Vodafone is insourcing talent by hiring full-time employees. In 2021, the company announced its intention to hire 7,000 new software engineers.

But many CSPs are also turning to systems integrators for help with staffing. “[CSPs] are looking for insourcing of cloud and AI experts at the architect level – so, at a high level,” says Ashish Yadav, Senior Director, Engineering, Capgemini. “They can live with outsourcing at the engineer level, but at the architect level it’s insourcing and especially for these key areas of cloud, AI, cybersecurity.”



**[CSPs] are looking for insourcing of cloud and AI experts at the architect level – so, at a high level.”**

**Ashish Yadav, Senior Director, Engineering, Capgemini**

CSPs’ definitions of insourcing can vary, Yadav adds. While working with a systems integrator might seem like outsourcing, many operators view it as a form of insourcing because the consultants become like part of the CSP family.

“When our expert goes and sits with the customer as part of their team, the customer considers this more like insourcing, even if it’s sort of outsourcing,” Yadav

explains. “Our employee doesn’t become their employee, but [the CSP] gives that employee a badge and that employee works with them as part of their team.”

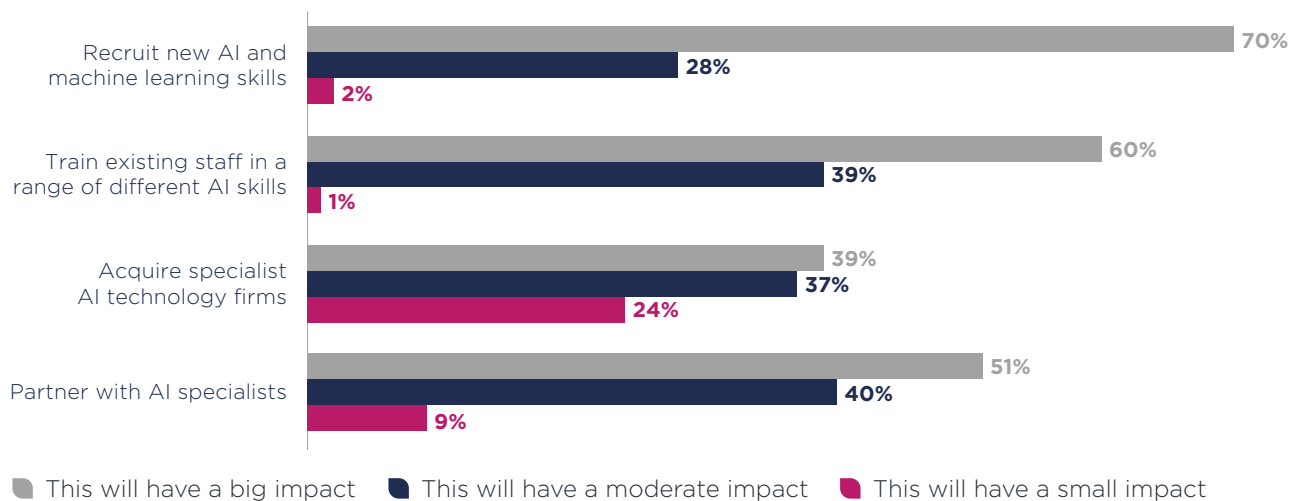
### Reskilling and upskilling

Most telcos are also reskilling and upskilling to get the AI talent they need. In fact, this approach is becoming necessary for all skills that are difficult to recruit, and it can be more cost effective than hiring new employees. US telco Verizon, for example, is retraining many of its senior developers in AI and machine learning.

Deutsche Telekom, MTN Group and Orange all have reskilling and upskilling programs to develop AI and cloud talent internally rather than trying to compete for scarce skills on the open market. MTN, for example, is partnering with hyperscalers to help employees develop new skills.

Microsoft is MTN’s primary cloud partner, which gives the CSP “extensive access” to the cloud provider’s learning platforms,

## What do operators need to do to give themselves the best chance of effectively exploiting AI and machine learning?



TM Forum, 2023

according to Ayedime Amadi, Group Senior Manager, Enterprise Architecture & Customer Channels, at MTN Group, who also leads TM Forum's [TechCo Organizational Design project \(TCOD\)](#). "We have a very deliberate structure to ensure that people can learn and upskill through the cloud partnerships," she says. TCOD is a framework to help organizations address operations, people and culture in their digital transformation projects using the Open Digital Architecture.

In our CSP survey for this report we asked what operators need to do to exploit AI and machine learning. Training existing employees across a range of AI skills was considered to have a significant impact by 60% of respondents while 70% said the same for recruiting people with new skills. Partnering with AI specialists was seen as having a big impact by 51% of respondents (see chart above).

GenAI specifically is forcing CSPs to develop AI expertise internally, [according to McKinsey & Company](#). The consultancy points to two unnamed telcos, one that continued to outsource its AI talent and another large company that created a dedicated team of 10 AI data scientists and engineers. "In the time the first telco took to draft requirements for outsourcing gen AI use-case development, the second built and deployed four gen AI solutions," McKinsey states.

GenAI requires new skills like "prompt engineering" (Google [defines this](#) as "the art of asking the right question to get the best output from an LLM"). Operators also need to hire data engineers and subject matter experts "who understand what data to collect and how, and who can oversee daily quality reviews as new forms of data are generated and consumed by these systems", according to McKinsey.

"Some telcos are setting up internal certification and university-led training programs to ensure their teams have the right skills and capabilities to innovate and execute with the technology," the company adds. "For instance, the large telco created a badging system to identify gen-AI-ready employees who have completed the company's sessions on use, risk, and effective prompting techniques given by its AI, legal and risk experts."

On the next page we look at China Mobile's Jiutian AI platform. And in the next section we look at operators' approaches to data and how they are taking steps to get it ready for an AI future.

## China Mobile's Jiutian AI platform requires new skills and training

China Mobile is made up of 31 local operators serving nearly a billion mobile customers. The company, which also operates a hyperscale cloud platform, is transforming from a traditional CSP into an “innovative information services provider, with a focus on AI technology innovation”, according to Dr. Lingli Deng, who works as a director-researcher in the company's R&D group responsible for developing its Jiutian AI platform.

**Watch this video to find out more about how AI is central to China Mobile's network automation strategy:**



China Mobile unveiled Jiutian in 2019 as a platform to support the company's transition to autonomous networks. The operator is aiming for its networks to be [highly autonomous by 2025](#). The AI platform is also accessible to external developers via open APIs. In October 2023, China Mobile announced that it has also developed [its own LLM](#) as part of Jiutian.

The team that supports China Mobile's AI efforts is growing quickly. What started as a 20-person team about seven years ago now has more than 600 people, and the aim is for it to reach 1,000 employees by the end of this year, says Deng.

Setting up the team and retaining employees has been challenging because AI skills are in demand everywhere. “That is why we set up a special organization and are offering competitive salaries to the market,” Deng says. “AI is our strategic direction, and we need the top talent in the nation to achieve that goal.”

China Mobile provides a group-wide learning platform for reskilling and upskilling employees to take on new roles in AI development and maintenance, and it partners with top universities in China to develop AI skills. The average age of the Jiutian team members is under 30.

Employees in China Mobile's AI group often work with teams at local operating companies to help them implement AI pilots and scale deployments. This includes providing training and onboarding them as members of R&D projects, so that they can acquire the skills they need for daily

operations, according to Deng. “And they can develop their own AI applications based on our platforms to enable their day-to-day operation routine,” she adds.

China Mobile offers courses focusing on AI project management and for data scientists who collect data and apply labels so that it can be used as a source for AI applications. The company also offers training in LLMs and for AI application developers, a role that is further divided into algorithm developers, engineers and application architects.



**AI is our strategic direction, and we need the top talent in the nation to achieve that goal.”**

**Dr. Lingli Deng, Director-Researcher, China Mobile**

## section 3:

# getting the basics right – is CSP data AI-ready?

A regular theme in our conversations with operators for this report was the state of readiness of data to use for AI applications and, in the medium-to-long term, to deploy at scale. For many, there are still considerable challenges in terms of putting coherent data strategies in place in order to exploit AI technology to the full.

The CIO from one large European telecoms group told us during research for this report: “I always tell our CEO it’s data before AI.”

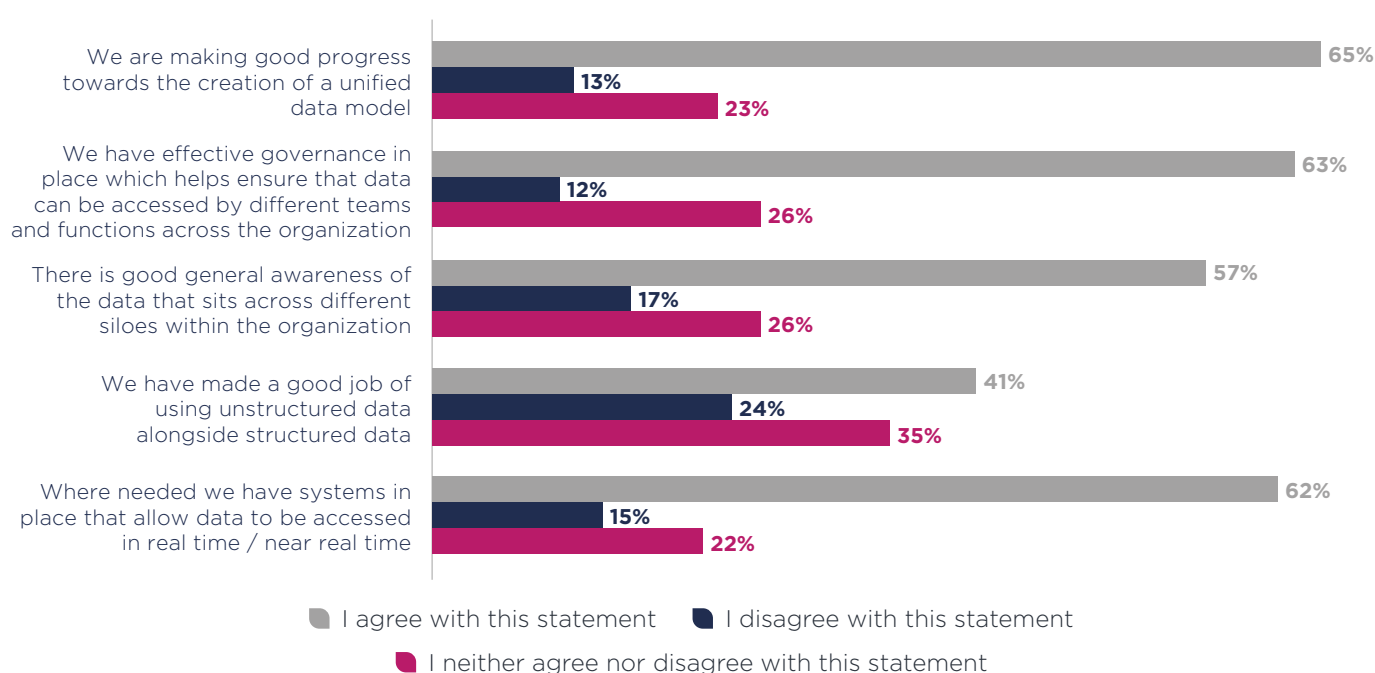
Yet our industry survey suggests that CSPs are relatively happy with the progress they have made in their organizations in making

data available for AI and machine learning (see chart below).

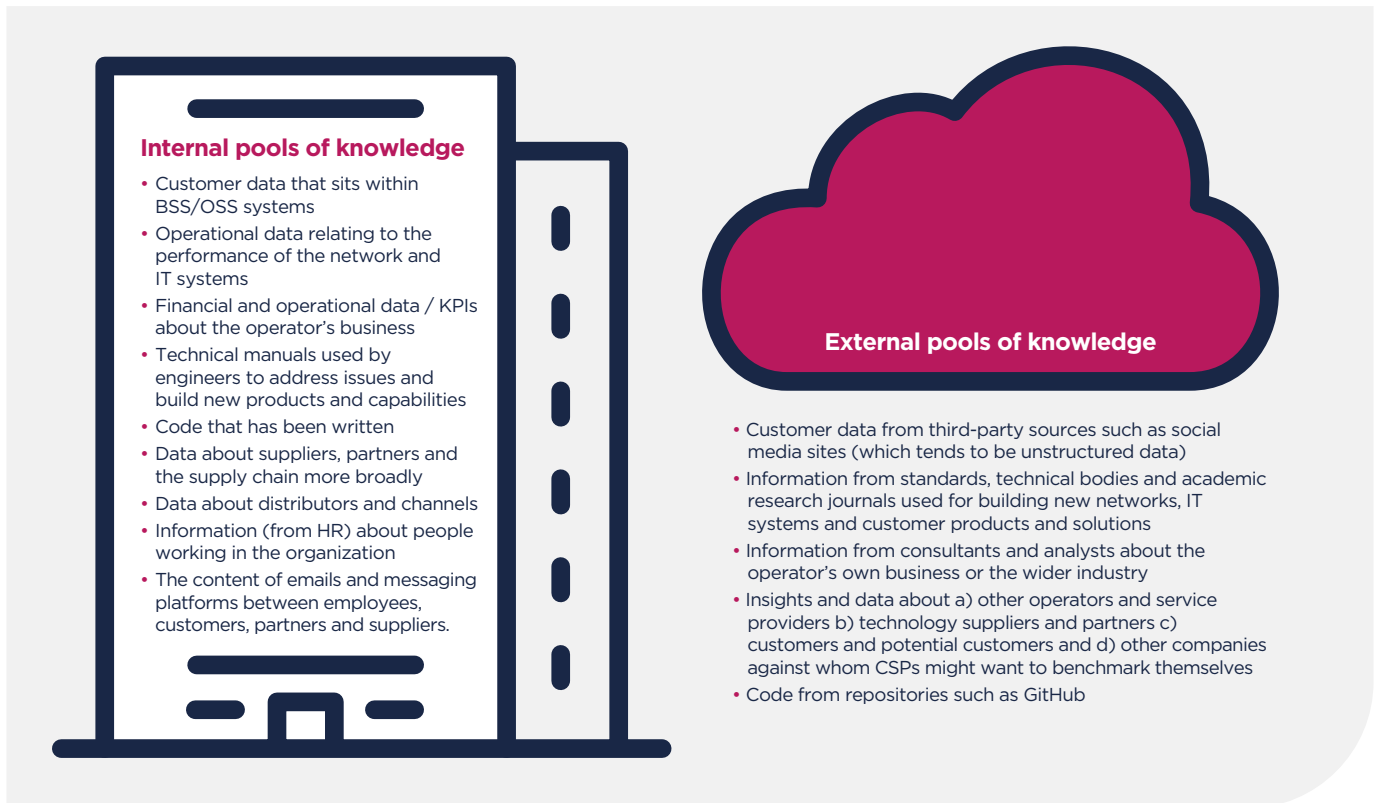
The only area where, based on the results of the survey, operators say they still come up short is in the use of unstructured data. This is a particularly relevant topic when it comes to GenAI, which potentially offers a short-cut to

leveraging unstructured data, a subject which is explored in detail in section 6. Rather than having to go through a slow, difficult process of cleansing, consolidating and labelling the data, there may be scenarios where unstructured data can be put straight into an LLM.

## How successful has your organization been in making data available for AI and machine learning?



TM Forum, 2023



However, our analysis is that those operators which are still at the early stages of experimenting with AI may be underestimating what is required – in terms of data – to deploy AI at scale and with success. Those CSPs which think they are in a relatively good place when it comes to readying their data for scale deployments of analytics and AI may come to a different view when they actually start to build and run models.

### Challenges to AI-ready data

CSPs face some specific challenges in getting data AI-ready – all of which potentially lead to distrust of the accuracy of data-led insights and actions. They include:

- **Lack of clean data.** CSPs we spoke to for this analysis reported a lack of clean, consistent and useable data which can be applied across different parts of the CSP

business, from networks to service delivery and customer experience. Getting this part right is critical for all processes around AI-based, data-driven execution.

- **Lack of a common data model.** CSPs use data from systems developed by different vendors over many years. Without a common data model, bringing together this structured and unstructured data is a hugely time-consuming process. Indeed, many data science teams spend more time cleaning up data than they do analyzing it to provide actionable insights.
- **Lack of data context.** Not fully knowing how, when or where data was captured, and when it is useful or not, creates reluctance to make data-driven decisions. This is a particularly significant obstacle for CSPs to overcome

if looking to implement GenAI or any other type of machine learning models.

With telecoms, pools of knowledge exist both inside the operator organization and outside. The graphic above defines some of those aspects.

A data model is a design for how to structure and represent information so that it can be used consistently across disparate systems. The problem is that most CSPs work with tens or hundreds of vendors whose systems generate and/or consume data, all using different data models.

### Telco data sources

CSP approaches to becoming data-driven organizations have typically centered around operational function. They have organized their IT operations around linear software processes managed by separate teams:

fulfillment, service activation, assurance and so on. Each domain owner has its own suite of data tools, controls and processes. This divided responsibility and tooling often leads to the emergence of data silos, data duplication and a lack of reusability of data across the organization.

As the perceived value and usage of data has increased, operators have stepped up their investment in data analytics. Telecoms and IT research firm [Omdia estimates](#) that CSPs’ global spend on data analytics services will increase from \$2.3 billion in 2022 to \$2.5 billion in 2025. But in reality, the time and investment in collecting, cleaning, transforming and storing data in the right format is often disproportionately higher than the time spent using that data.

However, the advent of AI-driven analytics and initiatives to tackle operational efficiency, drive service innovation and enhance customer experience, has accelerated the need to leverage data in a more transformative way:

- AI / machine learning requires vast volumes of data to train models
- Ensuring unbiased AI results requires diverse data sets and a wide range of data types
- Adding layers of data can improve accuracy of models and the impact of applications
- Models must be continuously trained with the latest information to maintain predictive performance, particularly in dynamic environments
- Data must be available in real time for critical business functions, principally in the network
- The advent of GenAI has given CSPs the opportunity to leverage the vast amounts of

Examples of CSP data types

| Structured data                                                                                  | Semi-structured data                                                                                 | Unstructured data                                                                              |
|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| predefined data models<br>easy to search<br>text-based                                           | loosely organized data<br>meta-level structure that could contain unstructured data: HTML, XML, JSON | no predefined data models<br>difficult to search<br>text, PDF, images, video                   |
| Stored in:                                                                                       |                                                                                                      |                                                                                                |
| rows/columns, as:<br>relational databases<br>data warehouses                                     | abstracts and figures, as:<br>relational databases<br>tagged text format                             | various forms, as:<br>applications<br>data warehouses/lakes                                    |
| Examples:                                                                                        |                                                                                                      |                                                                                                |
| dates<br>phone numbers<br>social security numbers<br>customer names<br>transactional information | server logs<br>e-mail sorted by folder<br>tweets with hashtags                                       | documents<br>e-mails and messages<br>transcripts<br>image files<br>open-ended survey responses |

TM Forum, 2024

unstructured data that sits within their organizations. This needs to be tagged and cleaned before feeding into LLMs.

Many CSPs still lack a cohesive strategy that enables data to flow horizontally across the organization in a single data model. Essentially, that would mean acting as a single entity, and not functionally separate in terms of where data is processed and resides in the organization.

Consolidating data

Breaking down these operational silos requires a holistic approach to data, which plays out across systems and processes. But it also requires a cultural shift. CSPs already have initiatives underway to move toward this, but there is not always a board-level strategic drive to bring data capabilities together, so progress is often slow.

CSPs need to consolidate multiple data types and structures from many sources into a single repository, across ordering to fulfillment, network optimization

to service orchestration, and service assurance to billing. This consolidation makes it easier for everyone involved in the AI / machine learning lifecycle — from data preparation, to model building to application deployment — to share data and collaborate effectively to derive valuable insights with speed.

But bringing network, operations and customer-centric data together into a “single source of truth” is a significant challenge, not simply due to the rapidly rising volumes of data but also because of the widely varying formats in which it is created and stored (see graphic above).

Data may arrive in real time, so must be harnessed for real-time predictions in use cases as diverse as fraud detection or product recommendations, and AI / machine learning-powered applications must be able to handle the extra load as use cases proliferate. If an application cannot scale, performance bottlenecks will diminish the value of using AI / machine learning. And to have an

AI application that is relevant, accurate and scalable, CSPs need to make sure that their data is of high quality and easy to access and share securely within the organization and with partners.

### A new data architecture

A data-driven architecture is key to maintaining precision and consistency across domains within the CSP, using a common data model to ensure that data flows smoothly through all systems and accurately feeds all automated workflows. Many CSPs have made progress on this kind of automation – indeed, TM Forum's [Open APIs](#) and [Open Digital Architecture](#) are central to helping with this need – but end-to-end automation has remained elusive because of interoperability issues, architectural fragmentation and customization.

A common, industry-agreed data model would allow CSPs to buy products and services from different vendors knowing that they could re-use data across systems, and it would help them partner and develop new services more quickly. As part of TM Forum's [Open API](#) and [AI, Data & Analytics Project](#) collaboration work, operators and suppliers are developing common data models.

CSPs urgently need to modernize their data architectures and they want to play a key role in shaping them – something of a shift, with vendors typically having heavily influenced telco data architecture modeling previously. The [TM Forum Information Framework](#) (SID) provides an information / data reference model along with a common vocabulary for implementing business processes. It provides the basis for a common data model and a common data dictionary and offers a foundation for function, application, component and API development. But CSPs are saying

### Setting the right foundations to fully leverage data for AI

CSPs need to get essential building blocks in place to fully exploit the data residing within their organizations for AI applications.

#### Data compliance

There are extensive reputational and financial ramifications to violating data regulation – such as [General Data Protection Regulation \(GDPR\)](#) in Europe. Given that sensitive customer data forms the backbone of CSPs' core operations, they must ensure full compliance while interacting with data. This could entail a full re-examination of how they collect, store and use their customer data as well as reinforcing diligence around compliance.

#### Data culture

The data strategy drives cultural change within the CSP and relates to the structure of the data science capability. Approaches vary within CSPs: from building a central team (likely in IT) under a chief digital officer; taking a decentralized approach with data experts in

different departments and lines of business, all using a unified set of rules and a common approach to governance; or taking a flexible approach by moving experts around and (de)centralizing based on changing requirements.

#### Data skills

Another consideration is putting in place the necessary data-centric skill sets, often for very specific disciplines. For example, some tools are geared towards business intelligence and not machine learning. CSPs need to be able to build teams that can use new AI-based tools to leverage data at scale and generate insights, whether to drive operational and energy efficiency, or enhance services.

**Read our report to find out more about exploiting data to drive future strategies:**



they need a reference architecture that looks at data beyond SID compliance and runs not only on telecoms networks but also effectively enables them to manage new business models.

In December 2023, the Forum [launched a new data reference architecture](#) for the telecoms industry that aims to encompass both new AI-enabled business models and network operations. The new project reflects network operators' need to build AI-driven autonomous processes, put data and AI at the core of operations, and bring external data into their

meta-ecosystems. It also sets out to tackle the question of what a modern data architecture should look like for AI-enabled telecoms operations.

The Modern Data Architecture for Telecom Operations Project was launched in collaboration with eighteen CSPs, including Axiata, China Mobile, MTN, Orange, Telefónica, Telenor, Vodafone and Zain, in addition to suppliers and systems integrators Accenture, Cloudera, Ericsson, Huawei and Infosys.

TM Forum Members can view or [join the new project here](#).

Drowning in data lakes

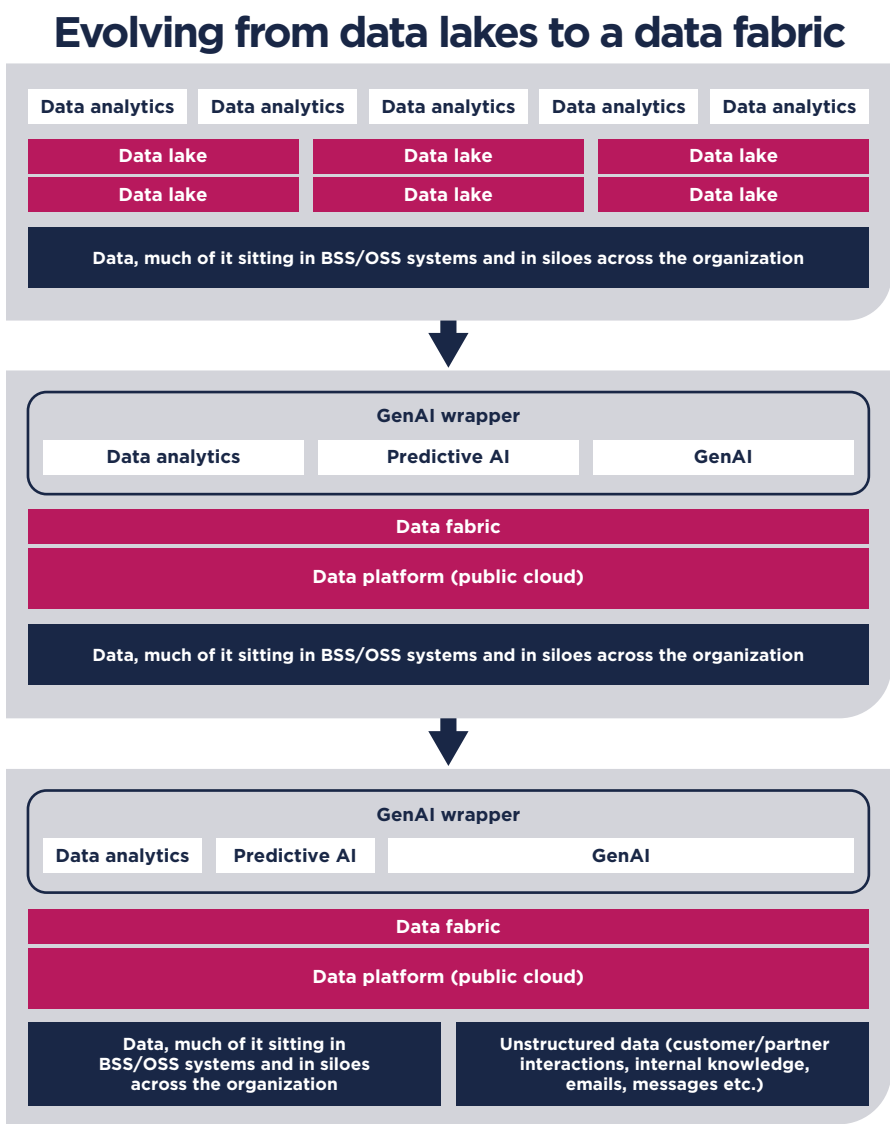
The process of creating data lakes and data warehouses has taken place over many years, but it has not given CSPs the capabilities to deploy AI at scale across the organization. The problem is that data sits in different on-premises, private and hybrid cloud environments and is stored in proprietary systems and formats.

That inevitably leads to duplication of effort because teams have different approaches to data models and each one requires bespoke massaging of the data to perform analytics and run AI models. To get an AI model into production could take as long as six or seven months, according to the CIO of one south-east Asian telecoms group we spoke to.

In addition to data fragmentation, many CSPs struggle with a culture of data usage and data sharing that makes it impossible for a single source of truth to exist. “Right now we have this culture where we say ‘give us the data’, or ‘give me a copy or dump of data’,” said the SVP of data analytics and AI at a large central European telecoms group. “In the future we need to say no to this and we need to have a single golden source of data.”

Building a single source of data is an extremely complex task that has been beyond the capabilities of most CSPs until now, because of the fragmentation of the data. But operators such as BT, Deutsche Telekom and Telefónica have taken steps to address this by moving all their data into the public cloud. BT, for example, [has moved more than 90% of its data into Google Cloud Platform](#) in the past two years.

But this does not, in itself, create a clean set of data. There are many inconsistencies and inaccuracies in the data that is pulled together – for example, duplicate identities,



The graphic shows the progression from data analytics in an age of fragmented data sources sitting across multiple data lakes and warehouses, across on-premises, private and hybrid cloud environments and stored in proprietary vendor systems and formats.

In the next stage operators move data into a single platform in a public cloud environment used for data analytics, predictive AI and GenAI. GenAI is both a vertical pillar alongside analytics and predictive AI, and a wrapper around all the three pillars, providing access to the different outputs.

The third stage demonstrates the potential for adding to the available pool of data within the organization by accessing unstructured information and knowledge that sits within the business, its employees, its customers and its partners.

TM Forum, 2024

also known as ghost or orphaned identities, when the same person appears as two separate people.

To overcome such difficulties BT has built a “data fabric”. This allows the source systems data, and the permissions associated with them, to be brought into the public cloud environment, thereby allowing inconsistencies and inaccuracies to be addressed. This is particularly

important when it comes to identifying, and addressing, potential privacy and security concerns around the data.

Harmeen Mehta, Chief Digital and Information Officer at BT, described the data fabric, in a briefing with us, as “one of the biggest things that we have invested in” and what “makes us really unique from any other company”.

In February, [BT Group's Digital unit](#) became the 10th CSP to achieve [Running on ODA](#) status. Running on ODA recognises that BT is now delivering products and services from reusable components, underpinned by cloud-native and vendor-agnostic solutions. BT's Digital unit was set up to simplify the operator's architecture and establish a data-first, AI-ready infrastructure.

Indeed, CSPs need to infuse AI into their future (open) architectures. This is a major focus

for [TM Forum members which have set up projects](#) to assess how to make data available in real time and create a standardized way of implementing intent-based automation.

Deutsche Telekom, meanwhile, describes its new data management strategy – which is broadly comparable to BT's – as a “hub and spoke” approach. Anyone in the business can use the data in the hub, with their own AI tools, but they are not allowed to get their own copy of the data.

In other words, they operate within their own spoke.

“You work in your spoke, but the source remains the same,” says Omair Ahmed Khan, SVP, Data Analytics / AI projects & Governance, Deutsche Telekom. “You can run your AI models on this inference and you get your outcome. But you don't get a copy of the data.”

In the next section we take a look at what operators are building and buying as they put the foundations for their AI strategies in place.

### Creating standards through an AI-enabled architecture

TM Forum is currently working with members towards a fully AI-enabled [Open Digital Architecture \(ODA\)](#). In an interview for Inform following the Forum's [annual Accelerate event](#), Andy Tiller, Executive Vice President, Products and Services, outlined some of those plans.

The Forum has been working on AI architecture, frameworks, governance and standards for about five years and has already embedded AI capabilities into ODA such as extensions to the [e-TOM Business Process Framework](#) and [Open APIs](#) for carrying intent, as well as reference architectures, maturity models and governance best practices. Now planning work is being carried out on how to fully AI-enable ODA.

Tiller outlines two key areas that are being addressed:

- The first is the data architecture. New uses of AI require data to be made available in real time and structured differently from the relational database tables used in traditional operational data stores and data lakes. This includes tapping into

huge amounts of data in real time, which is facilitated by data streaming architectures, as well as the use of knowledge graphs.

The challenge of how to create a data architecture which is fully AI-enabled and make that part of the ODA is a major new project, says Tiller. It includes how to share data across multiple parties within privacy constraints and regulation.

- The second key area being addressed is how you implement the reference architectures for intent-based closed loop automation in a standardized way.

“I heard one of our members describe the way AI is being used as a lot of artisanal applications hand crafted and bolted on,” says Tiller. “That's great for now because we need a lot of AI innovation and there are lots of very good use cases. But we need to start thinking about how we do it in a standardized way.

“We want to create standardized ways of implementing intent-based automation using ODA Components, [Canvas](#) and Open APIs. The aim is to avoid future

AI technical debt and the complexity and customization that's so expensive to maintain in legacy systems.”

Another significant activity within the TM Forum collaboration project work is exploration of GenAI applications. For example, the TM Forum AN Project team is working to explore how GenAI affects autonomous networks. To date the drive has been to use predictive AI models and machine learning to enable self-healing and optimization of networks, says Tiller, who notes that GenAI is good at generating content but not so good at making predictions and decisions. But, he adds, “together there is complementarity”, so the team has found use cases where GenAI can be used to great effect to help with automation of network operations.

#### Watch the video:



## section 4:

# Architecting, building, buying and scaling AI

**Many parallels can be drawn between AI / GenAI and the advent of public cloud: it is transformational technology, it is dominated by hyperscale service providers, and operators need to work out precisely how and where to deploy it. But there is a marked difference when it comes to approaching the question of what to build and what to buy in relation to IT systems.**

Going back 10 years or so, many operators built their own public cloud in an effort to compete with hyperscalers. Most have now exited the business, although there are still some operators – such as Deutsche Telekom, Orange and Proximus – [offering sovereign cloud services](#).

CSPs have come to accept that they cannot compete with hyperscalers, except in specific circumstances where their national identity lends them an advantage. Whether CSPs can rival hyperscalers in developing new technologies is an interesting discussion and one which is particularly pertinent to GenAI and LLMs. We discuss this specifically in section 6.

At the same time, however, there is a clear shift to CSPs developing their own in-house technology capabilities as they transition to open, composable architectures. This is a response to the technical debt they have accumulated over 20 years or more by investing in systems that cannot be easily swapped out, reconfigured or upgraded without costly customization.

As operators embark, or continue, on their AI journeys, their approaches will be shaped by the extent to which they embed openness and composability as core principles. Deutsche Telekom's Omais Ahmed Khan says that most of his company's AI projects involve a combination of building and buying different elements.

"We have a combination of a build and buy strategy, and the buy part has never involved our buying a full-fledged turnkey solution," he says. "We would not, for example, turn to a consultancy firm and say: 'here's the business problem, fix it'."

As CSPs launch themselves into the AI era it is essential that they remain true to their principles. The risk is that, faced with pressure from business leaders to deploy solutions and to show results quickly, they will set out on a path that will lead to their accumulating technical debt in the future.

At the same time, however, aggressive experimentation and the creation of [minimum viable products](#) (MVPs) is, undeniably, a good thing. Furthermore,

knowing where technical debt may accumulate can be difficult. As new technologies, systems, approaches and solutions emerge in AI, some of the incompatibility issues that might lead to technical debt will necessarily be addressed and solved.

Never has there been a time when CSPs need to be more alert to the potential of a new set of technologies while, at the same time, arming themselves with the knowledge and the skills to make sound decisions that allow them to sustainably benefit from new capabilities.

## AI architectures

CSPs are still at the very early stages of trying to figure out how AI fits into their enterprise or reference architectures. Indeed, the feedback from the majority of CSPs we spoke to is that it is too soon to start creating a reference architecture. There are a number of factors at play:

- AI is moving too quickly to build it into a reference architecture

- CSPs need to make more progress in terms of simplifying their existing IT estates and shutting down old systems before they can consider where AI fits
- CSPs need to decide what they want their new operating model to be before they consider where AI sits in their enterprise architectures
- More work is needed to improve the accuracy and value of AI, where to find insights and how to deliver better outcomes before it can become a central pillar of an enterprise architecture
- CSPs lack the skills to embed AI into their enterprise architectures (see section 3).

So if it is too early to start embedding AI into a future enterprise architecture, what does that mean in terms of today's deployments? In practice, the focus of AI deployments to date has been "bolt-on" use cases – opportunistic usage of AI-enabled services and applications that

deliver specific benefits in terms of efficiencies, customer experience improvements or new revenues. These are explored more fully in the next section of the report.

Even if CSPs did have a clear vision and strategy for embedding AI into their future enterprise architecture, most would likely struggle to implement it because they lack the requisite skills, tools and capabilities to deliver effective results and a demonstrable return on investment. Readyng the required data in an easy-to-ingest fashion is one of the biggest inhibitors. As we discussed in section 3, the fragmentation of data – in terms of data models and data lakes – held and managed by different functions leads to duplication of effort and a slower overall process.

Another inhibitor relates to the processes that CSPs need to put in place to go beyond what Verizon Group CIO, Shankar Arumugavelu, describes as the "artisanal" nature of today's telco AI. He likens today's AI with the early days of software development.

In the early days of software development there was a heavy reliance on manual processes. The software lifecycle that developed brought in tools and capabilities including source code repositories and DevOps, where continuous integration / continuous deployment became possible. This all happened at different points in time and this is how software factories work today. Any organization that creates software at scale today runs a well-oiled software development cycle.

AI, on the other hand, has been done in a bespoke way. There are many different processes and stages that sit between identifying the relevant data to the delivery of the insight. To deploy AI at scale this process must be industrialized.

CSPs need machine learning ops like software teams had DevOps. This involves the creation of data pipelines coming into a data ingestion platform where data can be curated and enriched. Data modellers or data scientists can then do the feature engineering, and then once it is deployed they

**When we asked operators whether they are building AI into their enterprise / reference architectures it was clear that they are still, at best, at the early stages of formulating their strategies.**



**Chief Digital Officer, western European telco**

"We do not currently have any plans to embed AI within our enterprise architecture. This is not because I think it's not right, but because our enterprise architecture is very much telco focused and the type of skills are different. If I had the right people, yes, I would do it."



**Chief Digital Officer, Scandinavian telecoms operator**

"We are just in the process of setting our AI strategy for the next two years. But there is no way we can say that AI will be part of the enterprise architecture by 2026. It just moves too quickly."



**Chief Architect, Australian telecoms operator**

"We are working on a new release [of our enterprise architecture] which will have the beginnings of some AI principles...We want to make sure that, with no regrets, we get some of the foundations well and right...One area we are currently reviewing is the use of knowledge graphs and trying to balance out how human code knowledge will work with machine learning knowledge."



**Chief Architect, Scandinavian telecoms operator**

"AI is going to fundamentally change how we operate. It will become an integral part of the operation. And that operating model will drive our new architecture."



**Two years ago the production cost of AI was super-high. It took six to eight months to produce an AI model. Now it takes a matter of days.”**

**CIO, south-east Asian telecoms group**

can fix any issues with data drift – the process whereby the predictive power of a model gets worse over time – and perform any necessary fine-tuning.

This process of industrialization is made possible as operators move their data into public clouds and data becomes accessible in real time.

The CIO of one south-east Asian telecoms group, describes the process that his organization has put in place to industrialize AI as a “data factory”. This, he says, has massively reduced the time and the production cost of AI.

“Two years ago the production cost of AI was super-high,” says the CIO. “It took six to eight months to produce an AI model. Now it takes a matter of days. You can run the entire cycle much faster and with less people.”

By industrializing the creation of AI models, CSPs are in a much better position to use AI as challenges and opportunities present themselves in the business. The south-east Asian CIO cites the example of one operator whose churn prediction model failed

because of macroeconomic factors. Using the AI factory, it was able to build five new churn prediction models in just three months saving the business significant amounts of revenue.

“This would have taken a year before we had the AI factory,” says the CIO.

### The AI technology stack

When you consider the overall AI technology stack it’s useful to look at where CSPs are building out solutions and where they are buying from third parties.

A handful of operators worldwide are investing in building their own AI (computing) infrastructure. Each of them is doing so as part of its strategy to develop products and services for the B2B market.

Asia is a particular hotbed for AI infrastructure investment [as we have outlined in stories on our Inform website](#). Developments include:



**China Mobile:** The Chinese operator has bought hardware, and built its own data centers containing [graphics processing units](#) (GPUs) and accelerators as part of its [Jiutian LLM project](#). It is also training the data, and building LLMs, from a number of other different vertical markets.



**Jio:** Reliance industries, the parent company of Indian telco Jio, [has partnered with Nvidia](#) to build supercomputing infrastructure for AI. Reliance aims to provide AI infrastructure to scientists, developers and start-ups across India as well as create AI applications and services for its 450 million Jio customers.

## SoftBank

**Softbank:** The Japanese tech group has [also partnered with Nvidia](#) to build data centers designed to host GenAI and wireless applications on a multi-tenant common server platform. The new data centers will handle both AI and 5G workloads, with Softbank exploring 5G applications for AI factories, autonomous driving, augmented and virtual reality, computer vision and digital twins.



**SK Telecom:** South Korean telco SK Telecom is [pursuing AI-driven demand for data centers](#) as part of its wider AI ambitions. CFO Yang-Seob Kim [says the operator plans to](#) “drive our data center business more strongly, focused on next-generation AI data centers and global expansion”.



**NTT:** Japan’s NTT is [setting up a new company](#) with Tepco Power Grid to jointly develop and operate data centers in Greater Tokyo. NTT Global Data Centers is investing ¥1.5 trillion (about \$12 billion) over the next five years to expand and upgrade its data center business globally, citing a worldwide opportunity to meet demand for data usage linked to rising use of GenAI, among other technologies.

However, these operators are the exceptions rather than the rule. The trend over the past ten years has been for CSPs to quit the data center business. The exception is those operators in countries with strict privacy and security laws that create a demand for national public cloud services. In Switzerland, for example, [Swisscom is partnering with Nvidia](#) to build GenAI full-stack supercomputers.

Swisscom's motivation is the potential to build expertise in GenAI – and potentially products and solutions – for the B2B market.

### Public or private cloud?

Deciding where to deploy AI is not a clear-cut choice for CSPs. Public cloud provides substantial computational resources, energy and specialized hardware required for processing complex algorithms and large amounts of data. However, hyperscalers must address non-technical issues related to cost, economics, sovereignty and data privacy. Transit costs, for instance, may become an issue if a CSP solely uses a public cloud to process large volumes of data.

It is difficult to make a case today for building private cloud for GenAI unless the operator is building its own LLM – which is the case with China Mobile, [Softbank](#) and [SK Telecom](#) in Asia, for instance, and [Deutsche Telekom in Europe](#). No operators are deploying GenAI at scale today, and until they do so – and it becomes possible to make

comparisons between running use cases in a private or public cloud – operators will favor public cloud for experimentation and for building MVPs.

What's more, many CSPs will likely choose to buy LLMs from other specialists, including from alliances such as the [Global Telco AI Alliance](#).

### Hyperscaler relationships

As CSPs increase the use of AI across their organizations it inevitably leads to a deepening of ties with the major hyperscalers – Amazon Web Services, Microsoft Azure and Google Cloud Platform – and a significant increase in spend on their services.

“The biggest investment we have made in AI so far has been in Microsoft copilot,” says the chief architect of one Asian CSP.

“Our spend on Microsoft has doubled,” says the Chief Digital Officer of another CSP from northern Europe.

While spend with all hyperscalers has increased as a result of the growing usage of analytics and AI

more broadly, there has been a more recent spike in spend with Microsoft which has added GenAI-driven services to its suite of Azure services.

However, the dependency on such a small number of hyperscalers – all of which inevitably deploy resources in larger countries with the biggest markets for their services – potentially places CSPs in smaller, less developed countries at a disadvantage. This is particularly true when it comes to securing the resources and collaboration needed to work on large deployments.

“Mobilizing and committing to getting things done is very different [from just talking about it],” says the CIO of one African telecoms operator. “Our hyperscaler just doesn't have the scale to get things meaningfully done in a reasonable timeframe. We had a lot of things that didn't work [in] the first three months.”

In the next section we look at some of the specific areas in which CSPs are deploying AI technology, ranging from networks to customer experience.

## Vodafone opts for partner approach after early open source building strategy

Vodafone's early investments in analytics and AI involved heavy investments in open source and building its own big data platforms. But it became clear after two or three years that it had invested so heavily in underlying platforms and technology that it could not scale and deliver real-life use cases. Furthermore, it was not keeping pace, in terms of capabilities, with hyperscaler service providers.

The operator then pivoted and [struck a large strategic deal with Google Cloud Platform](#). This allowed Vodafone to focus

its energies on building out use cases rather than managing the platform.

Vodafone builds most of its AI use cases in-house, rather than engaging, for example, with a professional services organization. These use cases are built on tooling provided by Google on its [Vertex AI platform](#) – a capability that lets organizations like Vodafone train and deploy AI models and applications. It combines data engineering, data science and machine learning engineering workflows.

Vodafone is also partnering with other industry big-hitters to develop its AI strategy. [In January, the operator announced](#) that it would invest \$1.5 billion over the next 10 years in cloud and customer-focused AI services developed in conjunction with Microsoft. The deal includes replacing multiple physical data centers with virtual ones across Europe. Another key area of collaboration will see the companies applying Microsoft Azure OpenAI to deliver real-time, hyper-personalized experiences across all Vodafone customer touchpoints.

## section 5:

# Where operators are applying AI

Despite the fact that CSPs have been working to build AI use cases over the past half a dozen years, most have had limited success. There are many reasons for this, but foremost among them – as we have detailed in earlier sections – are that they have been unable yet to make data AI-ready, they have lacked the skills and the tools to build an “AI factory”, and most operators do not have the requisite cloud and software skills and cultures.

Operators' use of AI / GenAI today – and in future – currently can be distilled into three broad categories:

- Employee efficiency, productivity and experience (internal)
- The network and network operations (internal)
- Marketing and customer experience (external).

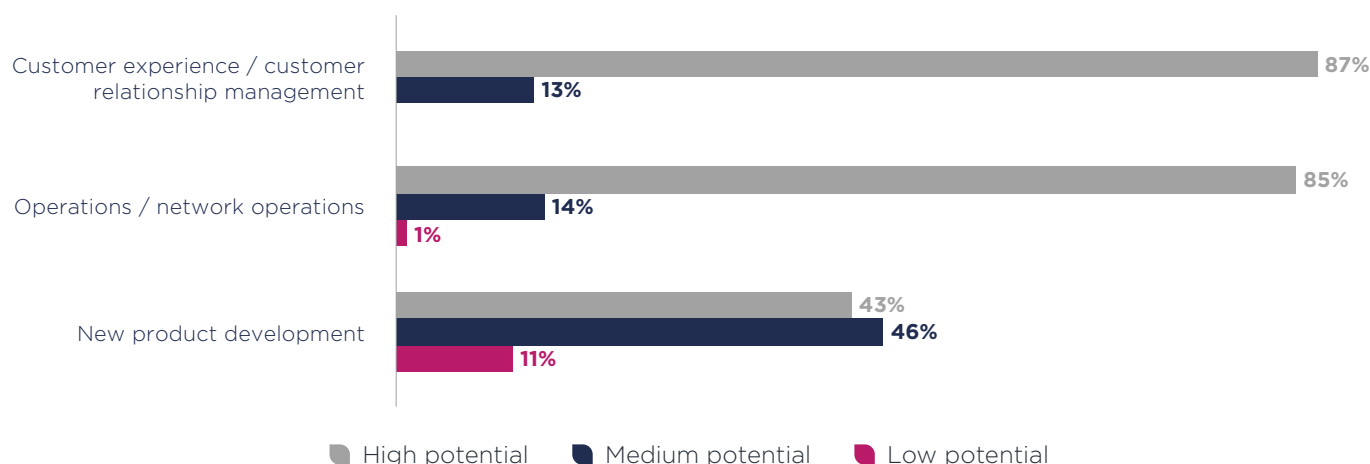
There is a case for adding a fourth category – AI for new products, services and revenues – but there are relatively few operators focused on this category yet.

In our CSP survey we asked our respondents where AI and machine learning had the most potential to positively impact the telecoms business. Results were consistent with our overall assessment of

where the best opportunities lie for AI and the fact that it is, perhaps, too early to make any bold assertions about the value of AI in new product development.

Operators have compiled lists of hundreds of use cases for both predictive AI and, more recently, GenAI, but most of these are still being evaluated. In some cases CSPs have built MVPs and in

## Where does AI / machine learning have the most potential to positively impact the telecoms business?



TM Forum, 2023

others they have gone into full production. But this does not mean they have necessarily yielded positive results. The artisanal nature of AI deployments to date means that many have been slow and expensive to deploy.

What follows in this section is an overview of where CSPs are applying AI in their strategies within the broad categories outlined above. We have covered many of the specific use cases in other reports, as indicated throughout, which can be read for further analysis.



### Employee efficiency, productivity and experience

BT hit the headlines last year [when it announced plans](#) to cut 55,000 jobs by 2030 – more than 40% of its global workforce – with 10,000 reportedly to be replaced by AI. But as we carried out research for this report it became clear from our conversations with senior executives that CSPs in general are not yet close to being able to use AI-enabled solutions to replace human functions. Rather, the value of AI today and

in the short-to-medium term is in helping employees to do their jobs more efficiently and, arguably, more enjoyably.

This will only change when CSPs are persuaded that AI is sufficiently robust, trustworthy and ethically acceptable to allow it to operate the network, make business decisions and interact directly with customers. If AI and GenAI fulfil their potential, such outcomes may be possible in the medium term. But it is not, currently, informing CSP strategy.

A more plausible scenario is that AI will change jobs and result in a requirement for new ones. For example, call center agents will be expected to spend less time understanding customers and interpreting their requirements – AI will help them to do this more quickly – and more time proposing solutions and, potentially, cross-selling and up-selling. Network engineers will spend less time looking for data that explains why the network has behaved in a certain way and more time putting measures in place to help ensure the problem does not recur.

The requirement for new roles is a function of the extent to which CSPs seek to build, rather than buy, AI use cases. Respondents to

our survey believe there will be a growing demand for new roles both in the medium and long term (see charts below and on p.29).

They also expect that more jobs will be created than will be lost as a result of AI.

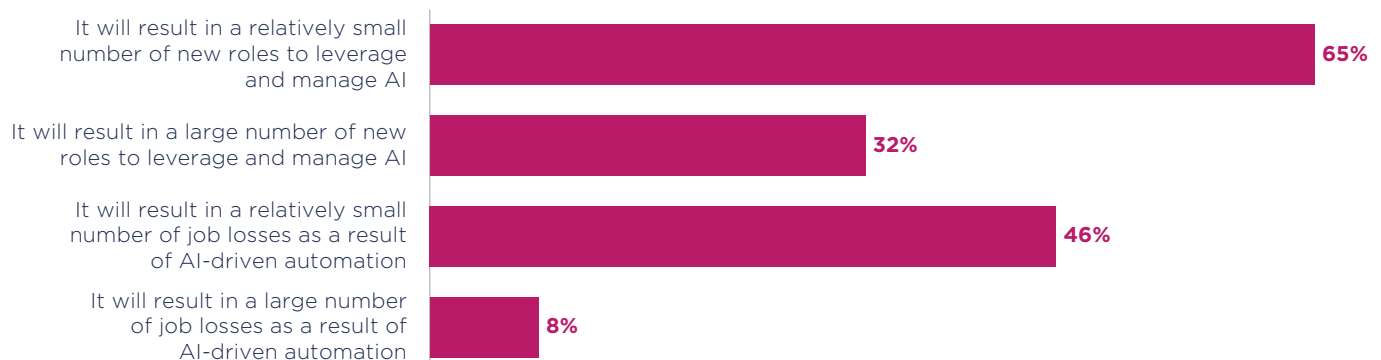
### Harnessing GenAI

Unlike other forms of AI, GenAI can be of value to employees because it can be applied to the basic tools of productivity and communications in every role. Furthermore, by making GenAI copilot services available on existing platforms and products, hyperscaler service providers are making it possible to extend AI tools to all employees quickly and simply.

Copilot services can be applied to a range of different roles and functions within the CSP organization. And they can help with a series of tasks, such as coding, writing and generating images.

Whereas traditional forms of AI have tended to be deployed in those parts of the business most comfortable with using new technologies, some of the biggest potential for GenAI is within functions that are least technologically advanced but where there is a huge amount of

## How do you expect AI to impact the types and number of jobs in your organization in the short-to-medium term (choose all that apply)?



TM Forum, 2023

## How do you expect AI to impact the number of jobs in your organization in the medium-to-long term (choose all that apply)?



TM Forum, 2023

knowledge and text-based content. HR departments retain huge volumes of information about employees, for example, while finance and legal functions process contracts with customers, suppliers and partners. GenAI can deliver huge efficiencies across such functions, although strong AI governance must be applied to ensure that ethical, security and privacy issues are observed.

GenAI for coding has been held up as an important use case, although the operators we spoke to for our research cautioned against its potential as an alternative to employees creating code. Deutsche Telekom is experimenting with using GenAI where there are small code vulnerabilities in large applications. It has built a tool which automatically fixes code created by humans.

Vodafone, meanwhile, has identified some value of using GenAI “to remove some of the drudgery” associated with certain coding functions, according to CTO Scott Petty. And Verizon is looking at whether using GenAI to write code potentially gives it the opportunity to free up some senior developers and retrain them in AI and machine learning.



### AI in the network, network operations and OSS

There are two main objectives of using AI in the network, network operations and OSS:

- Reducing cost and complexity
- Delivering new network experiences that leverage investment in fiber and 5G.

Reducing cost and complexity involves using AI to reduce both capex and opex. **Smart capex uses analytics and AI** to drive better informed and data-driven investment decisions for both fixed and mobile networks. [BT says it has made annual savings of £20 million](#) through its Sweeper project which involves the use of geospatial data to rethink how fiber networks are built. And [Verizon is using computer vision for its 5G urban network deployments](#) to better design how networks are built to make best use of available street furniture.

[A TM Forum Catalyst](#) is using AI / machine learning to automate and optimize RAN and FTTH rollouts with a target of unlocking 15%-20% efficiency gains.

**Energy saving** is another AI-driven use case for networks that many CSPs have taken into production. Savings, for example, are achieved when operators gain insights that inform them when and where they can shut down capacity on their networks.

Indeed AI is being used extensively by operators to inform their sustainability strategies in areas such as measuring energy consumption and implementing energy management information systems. **Read our report, The sustainable telco: engineering networks for net zero, to find out more.**



**Predictive maintenance** is a growing “bolt-on” use case for CSPs and an early example of how AI could be applied to telecoms. It enables CSPs to address maintenance issues in the network before a problem arises.

Another key use case, applying analytics and AI to transforming OSS systems, has been a major focus for Vodafone. The operator has replaced its OSS tools with AI and machine learning tools by extracting the data from its OSS systems and connecting it into its [Data Ocean](#) – a company-wide data analytics platform. The transformation project paid for itself in six months, according to CTO Scott Petty.

### Laying the foundations

Delivering new network experiences is an aspiration for every CSP investing in 5G networks. The basic premise is that network capabilities and experiences will become differentiated based on the customer, customer group, device or application that they support. But such differentiation implies a level of complexity that could only be supported by a massive increase in operational teams or the deployment of new AI-driven intelligence capabilities.

The box on p.32 explains the predominant AI-driven initiatives that sit within CSPs' technology (IT and network) functions, including network automation and autonomous networks. In considering the overall progress that CSPs are making in using AI to deliver network automation – and in pursuit of the ultimate goal of autonomous networks – a realistic assessment would be that the foundations are still being laid. These foundations comprise a company-wide data platform and common data sets – as detailed in section 3 – an enterprise architecture and a machine learning operations (MLOps) capability that enables operators to deploy quickly and at scale.

While some parts of the business may derive value from AI models that are not accurate – but, for

example, provide guidance – the network requires much higher levels of performance than is widely possible now. In a conversation with TM Forum CEO, Nik Willetts, KDDI Deputy GM and Executive VP, Tomohiro Otani, said that early efforts to build AI algorithms using data from disparate network systems yielded around 70% accuracy. But the operator has now managed to push accuracy up to between 95% and 100% by using a common data set.

KDDI created a testbed to generate data for AI, comparing algorithms for various use cases such as failure detection and root cause analysis to pinpoint the most effective algorithms for network operation. Data generated from different vendor systems – such as element and network management systems (EMS/NMS) – generated different “forms”, says Otani, so KDDI needed to collect the data processes into a common data set – bringing together lots of different data sets to train the model.

**Watch the video to find out more:**



### Marketing and customer experience

Some of the earliest use cases for AI were in specific areas relating to churn and customer experience. More recently, GenAI is being seen as a tool to help drive wider transformation.

Those early use cases include churn reduction through the creation of churn models that reduce the cost of

experimentation; and “next best action”, which involves transforming next best offers from static promotions to dynamic, data-driven experiences.

The main challenge with using AI in the marketing and customer experience domain is that a large proportion of the data is unstructured. It comprises the communication that takes place between the customer and a CSP representative, or digital touchpoint, and takes the form of the written and spoken word.

Operators have now started to use GenAI to:

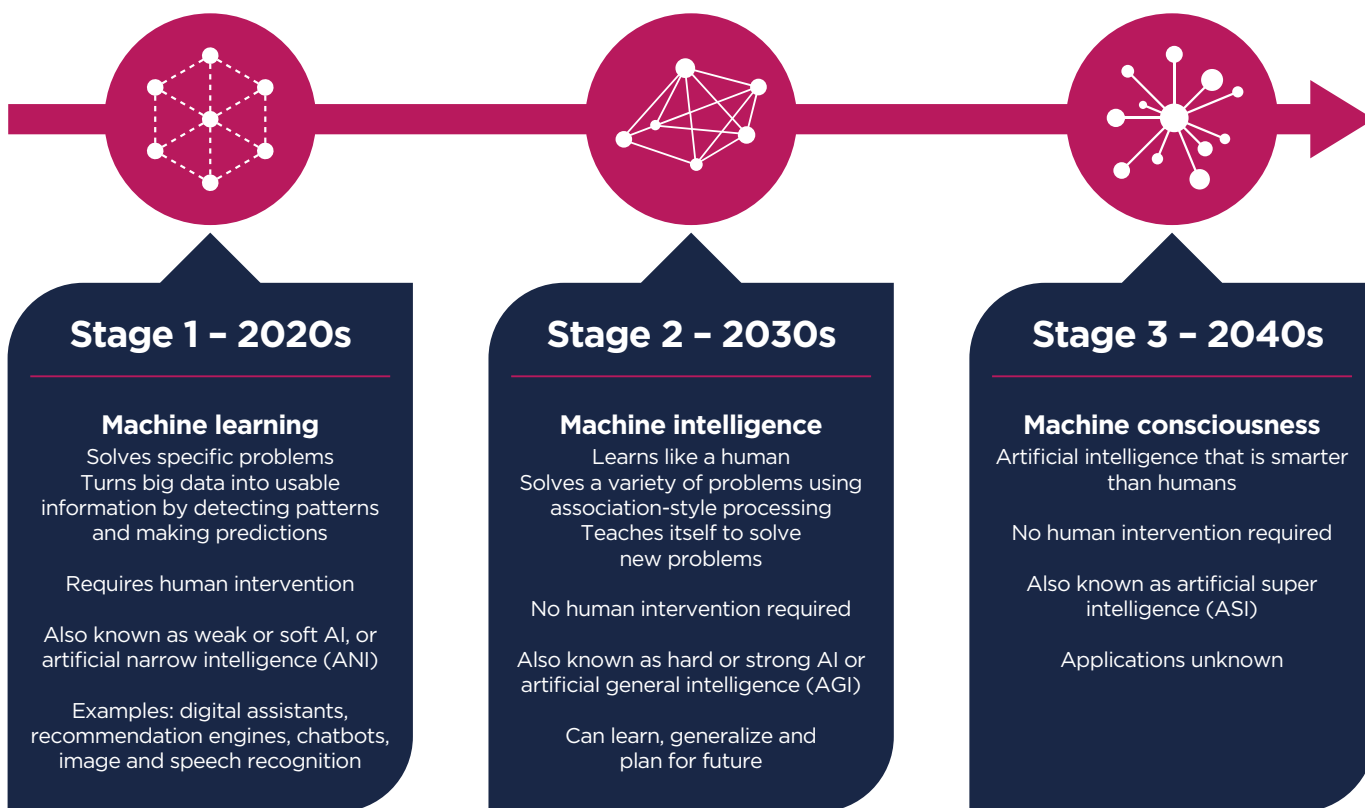
- Create insights both for contact center agents and for customer experience, marketing and sales teams
- Reconfigure customer chatbots and transition away from rules-based approaches to ones that are based on natural language processing and GenAI. Many CSPs are taking hybrid approaches.

AI will become increasingly capable of improving the customer experience and replacing agents or freeing them up to carry out other tasks. The graphic on the next page shows the stages of AI, during which progressively less human intervention is required. In the third stage, in around 2040, machines are predicted to become smarter than humans.

[Read our report, Counter intelligence: using AI to improve customer experience, to find out more.](#)

TM Forum Catalysts in the “customer” domain include [Hand over to the virtual assistant: Future contact center using GenAI](#), and [EBITDA Mastery: Remodelling revenue journeys with GenAI and intent analysis](#), which explores how GenAI can help give customers the services and packages that best suit them.

## Stages of AI



TM Forum, 2023 (source: Omnisperience)



### AI for new products and services

Asian CSPs lead the way when it comes to leveraging AI to build new products and services. Both SK Telecom and China Mobile are developing LLMs which – in addition to using them for their own internal requirements – they plan to monetize through sales and licensing agreements with other CSPs, with CSPs' technology partners and by partnering with industry verticals. China Mobile, for example, is building LLMs with healthcare and other industrial verticals. Its vision is to build solutions that integrate GenAI capabilities into 5G connectivity offerings.

CSPs with large IT services businesses are seeking to build

expertise in AI to be able to offer services and solutions to their customers. For example, both Swisscom and Telenor are partnering with Nvidia to build out AI infrastructure, with one of the key motivations being to develop expertise and solutions in their IT services businesses.

Korea Telecom has set up a dedicated [“AI/New Biz” services division](#). It includes robotics, logistics, AI-enabled contact centers and a myriad other applications, including video security, blockchain and “smart-space” services. As part of a new strategy [announced at MWC](#), KT will launch an internal business innovation platform dubbed Gen. AIDU that will enable users to “directly develop and use [GenAI] APIs”. The company aims to generate KRW1 trillion (about \$773 million) from AI-based services by 2025.

Rival Korean operator SK Telecom has a personal assistant service called A. (pronounced A dot), which the company says has garnered 1 million subscribers within just nine months of its launch. The service was revamped in September 2023 to offer personalized entertainment services driven by ChatGPT. At MWC, SKT [set out its “AI to everywhere” strategy](#), which includes working to expand into diverse industries and use cases including robots, media, data analysis, airports and manufacturing, machine learning and digital twins.

The next page defines key AI-driven initiatives being applied to IT and networks, while p.33 sets out TM Forum's collaborative work in AI and automation. In the next section we look at the impact of GenAI on CSP strategies.

## Applying AI to networks: defining AIOps, autonomous networks/operations and network automation

The categories AIOps, autonomous operations, autonomous networks and network automation represent four key AI-driven initiatives that sit within CSPs' technology (IT and network) functions. There is overlap between them, largely as a function of the convergence of enterprise IT and telecoms-vertical technology.

The four categories all embed the terms automation and / or autonomous. Automation is the use of technology to perform tasks where human input is minimized. The term "autonomous" means independent and having the power to make its own decisions. The two terms are different, but they overlap because for a system to be autonomous it needs processes within it to be automated.

**AIOps** is a term coined by the enterprise IT community and which refers to the enhancement of IT operations analytics using machine learning technology. Such operations include automation and performance monitoring. As such, it is a broad term that is applied, within the CSP, to the functions that sit under the CIO.

**Autonomous operations** is a concept which, according to TM Forum, "presents a new operating model of an organization that automates capabilities for learning, self-governance and self-adaptation of its value streams in order to realize stakeholder value in a closed loop fashion".

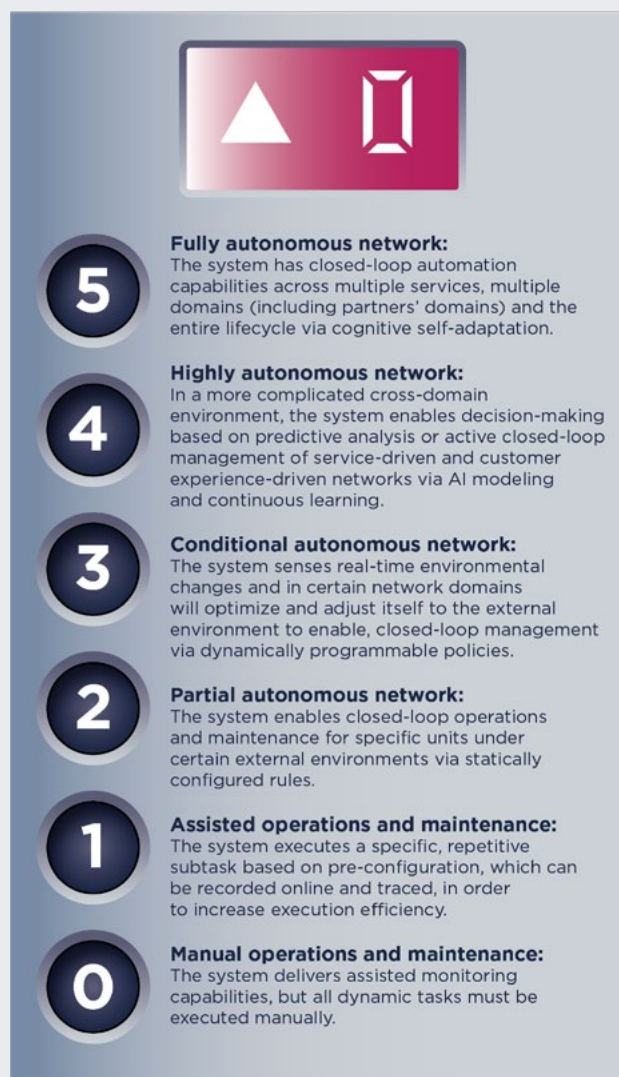
**Network automation**, according to Cisco, is "the process of automating the configuring, managing, testing, deploying and operating of physical and virtual devices within a network.

The vision of an **autonomous network** is one that operates autonomously, with minimal human involvement. Within the CSP context it represents an aspiration, a vision for the network operations function to use the concepts of intent and closed-loop automation to replace manual functions.

TM Forum has identified five levels of maturity for autonomous networks between 0 and 5. High levels of automation are required to get to Level 2, but to progress to Level 3 and Level 4 operators will need to deploy AI at scale (see graphic).

Advancing beyond Levels 2 and 3 to Levels 4 and 5 will require the use of AI. But AI will not, in itself, enable CSPs to make this progression. They will need to encode network knowledge in a structure that machines can reason with and to which they can dynamically adopt. "This requires the development of a comprehensive and robust ontology," says Telstra's chief architect Mark

### Autonomous network levels



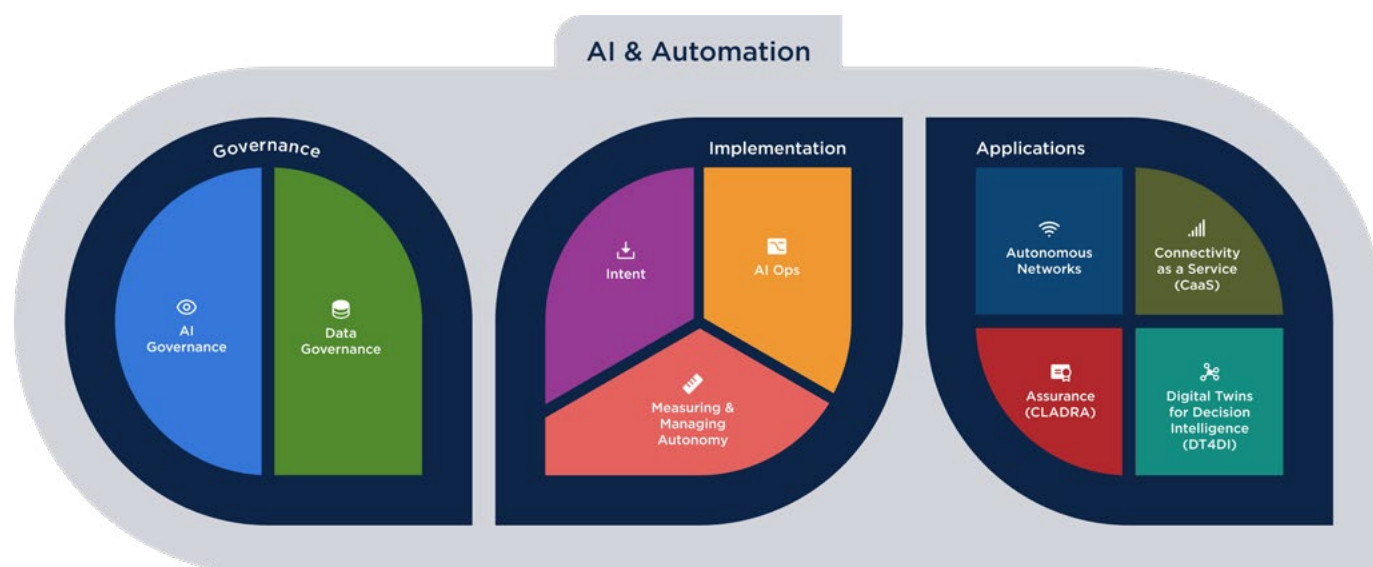
TM Forum, 2023

Sanders. In addition to mapping out network elements, this will need to encapsulate policies, behaviors, schematics and other dimensions of network operations.

Our report, [Leveling up: achieving level 3 autonomous networks and beyond](#), sets out the progress operators are making in moving up these levels.



## TM Forum's collaborative work in AI and automation



TM Forum, 2023

TM Forum members are working together in collaboration projects and Catalyst proofs of concept to solve common AI challenges for the telecoms industry. Central to that is a [new Innovation Hub](#), hosted by Jio in Mumbai, which opened on 1 December 2023. Founding members are Accenture, Deutsche Telekom, Google Cloud, Orange, Reliance Jio, Telenor and Vodafone.

Among the early projects will be the development of TMF Guru, a GenAI/LLM conversational search capability to simplify and improve how to find relevant material digitally. The project members are setting out to create an architecture blueprint that outlines how GenAI technology can be seamlessly integrated into the telco landscape, addressing

challenges related to security, privacy, accuracy, performance and scalability.

In the near term, TM Forum's AI innovation agenda focuses on gaining maximum benefits from AI, safely and cost-effectively, using existing IT and network systems and data. The medium-term goal is to exploit the full potential of AI to reduce operational costs and create opportunities for growth by taking AI from a bolt-on automation aid to an integral part of IT and network system designs.

The Forum's [AI collaboration projects](#) are creating standards and exploring best practice for AI-driven, intent-based closed loop automation, building an industry-agreed framework for

the use of AI in IT and network operations. Meanwhile, [Catalyst co-innovation projects](#) are turning ideas into proofs of concept as members explore applications of machine learning and GenAI.

Members can keep control of AI deployments and avoid accumulating technical debt by following TM Forum's best practice in AIOps and AI governance, and prepare for the future by upgrading IT and network systems for AI with TM Forum's blueprint reference architectures, ontology and Open APIs. Many operators are adopting the [Autonomous Networks Levels Evaluation Methodology](#) to set targets for network automation and track their progress.

## section 6:

# The impact of GenAI

Telecoms operators are not usually early adopters of new technologies, but the surge in interest in GenAI following the commercial launch of ChatGPT in late 2022 has proved an exception. It immediately captured the imagination of boardrooms, in part because even the least tech-savvy executives could see the power of the technology. The world's most pre-eminent consulting firms also helped ensure that the CEO community was wise to its potential.

For technology leaders this enthusiasm about GenAI was a double-edged sword. On the one hand they were given the freedom to experiment aggressively with the new technology; but on the other, it put them under pressure to deliver results without the comfort blanket of standardization or the guidance of traditional telecoms technology partners.

However, there are signs in early 2024 that the first wave of excitement and aggressive experimentation is abating and that pioneering operators are turning their attention to getting their first use cases into production. Many operators that we spoke to for our research believe that GenAI will, ultimately, be transformational. But they are well aware that they need to get some use cases up and running – and to clearly demonstrate business gains – to start building momentum. This is very much

seen as the year when operators start to put GenAI into production (see timeline on p.46).

In December 2023 we published our first piece of research on GenAI, [Generative AI: Operators take their first steps](#). This section draws from that research but also includes new insights based on our operator briefings. They revealed that:

- For a large number of CSPs, GenAI is now the main focus of their AI strategy.
- While much of the usage, and future usage, of predictive AI is in the network and network operations, GenAI's value is seen as driving internal productivity and customer-facing functions.
- There is a growing realization of the telecoms – and telecoms-function – specificity required for GenAI to deliver the accurate results needed

for scale deployments. At the same time, there is skepticism about the ability of the operator community to build its own LLMs.

- There is no clear, coherent strategy for collecting, consolidating, storing and using the vast amounts of unstructured data in, and around, the telecoms operator business and which does not currently sit in CSPs' data lakes / oceans / fabrics.
- GenAI exists both as a technology and capability to use for specific use cases and as a “wrapper” that sits around data analytics, predictive AI and GenAI that allows individuals to consume the output of different models.

In this section we explore some of these issues in more detail and point to how they are being addressed by the operators we spoke to.

## Building families of GenAI use cases



**For a more detailed introduction to GenAI, the technology, the emerging value chain and some of the broader challenges and opportunities, read our earlier report:**



### Where does GenAI sit?

There is no suggestion that the organizational structure that CSPs have put in place for predictive AI should, in any way, be revised or duplicated for GenAI. But at the same time it is already evident that the use cases for GenAI are very different from those for predictive AI. The two technology categories are not interchangeable, although in many cases one will complement the other. Furthermore, the technology stacks that underpin them, and the overall size and shape of the investments required to leverage them, are very different.

We have identified seven families of use cases for GenAI (see graphic above). Most of the CSPs we spoke to have identified more than 100 individual use cases in total – “We got to 120 and then we stopped counting,” one CIO commented – although the groupings of families of use cases may differ slightly from one operator to another.

Clearly no CSP can put more than 100 use cases into production, however. As such, they are having to prioritize, and based on our discussions the following two approaches – or sets of priorities – are emerging:

- Use cases that involve capturing content and knowledge from customers and using that to deliver a better, more tailored customer experience
- Use cases across the entire organization – many of which are in parts of the business that are not normally early adopters of new technology – which will deliver productivity gains. Many of these use cases will be made possible by the use of copilot services.

Indeed, these two approaches dovetail with the stated aim of the

Global Telco AI Alliance, which is developing LLMs for the telecoms community. In a statement providing an update on the alliance at MWC in Barcelona in February, SK Telecom CEO, [Ryu Young-sang](#), said: “We as telcos need to develop tailored LLM[s] for the telco industry to make telco operations more efficient, which is a low-hanging fruit. Our ultimate goal is to discover new business models by redefining relationships with customers. The Global Telco AI Alliance brings synergy to its members by allowing them to achieve more by working as a team.”

Many use cases sit within the first category. They include:

- Building customer-facing chatbots that embed GenAI. In most cases this means taking an existing rule-based chatbot and adding new capabilities and functions using GenAI for more difficult, customized queries.
- Complaint resolution. Customers send emails / messages and GenAI reads them and either forwards them as trouble tickets or resolves the issues.

- Service experience analysis. One European CSP interviewed for this research used GenAI to analyze the seven million pieces of customer feedback received over a year. It was able to get detailed insights into the nature of customer complaints broken down by service, type of complaint, time of day, date and so on. This enabled it to prioritize when and where to invest in delivering an improved level of service.
- Canadian operator Telus is using GenAI to predict when customers will have negative experiences – for example, when the network is likely to go down because an engineer is carrying out local repairs in the area.
- Using GenAI as a means of simplifying the customer experience. China Mobile is developing a feature on its mobile app which allows customers to use natural language to interact rather than going through increasingly difficult, complex menus.

In the general category of productivity, and the use of copilots, there are likely hundreds of different use cases across the business specific to the work of individuals, small teams and departments. However, there are some “horizontal” use cases that could be deployed across many different functions and departments.

Some of these are as simple as building knowledge and insights from disparate online and offline resources and communications channels. But one specific example that is particularly relevant and attractive to CSPs relates to knowledge transfer, learning and training.



**So long as you have a human being making the final decision, GenAI could be... providing innovative recommendations instead of actually making final decisions.”**

**Dr. Lingli Deng, Director-Researcher, China Mobile**

[According to Colt Technology CEO, Keri Gilder](#), CSPs are on a retirement cliff edge. Many of the roles within technology operations teams require expertise on legacy systems and technologies. As employees in these roles near retirement, operators need to find a way to capture their expertise and train new teams. GenAI can play an important role in this training or retraining process.

Call center functions face a different set of problems. Staff turnover is high and agents often leave just when they are acquiring the skills and knowledge to be effective. Using GenAI to plug skills and knowledge gaps can help CSPs to provide a more consistent quality of service from their call center teams.

What all of these examples and use cases have in common is that they put a CSP employee between the output of the LLM and the final decision that it is helping to influence. In addition, the output of the LLM can be useful even

when its accuracy is significantly less than 100%.

“So long as you have a human being making the final decision, GenAI could be playing the role of a data miner, and also providing innovative recommendations instead of actually making final decisions,” says China Mobile Director-Researcher Dr. Lingli Deng.

### GenAI in the network

While there are some use cases for GenAI in the network – for example, in planning – CSPs are largely skeptical about its application in the day-to-day running of telecoms networks. This view is shared by Chung Suk-guen, Chief Global AI Officer at SK Telecom. “I’ve met a lot of network experts in this industry that are trying to find some real-time data monitoring or root cause analysis use cases for GenAI. But I don’t think it’s possible at this moment,” he says. “GenAI is not fast enough to handle tons of data in real time. And also, the data is not human readable.”

Spanish telecoms group Telefónica does not currently have any GenAI use cases for the network in practice, but it is evaluating a number of different opportunities:

- The operator is training its LLMs with technical manuals for different network systems. The LLM can then provide recommendations and next best actions for field engineers. In trials, Telefónica has achieved a level of accuracy which it considers to be promising but significantly below the expertise of its own technicians.
- It is reporting detailed information back into the business about the network’s performance and where it is facing technical issues. This can be delivered using natural language.

- And it is looking to use GenAI to build a natural language interface with the network – for example, interrogating different networks and network functions about how the network is performing.

A TM Forum catalyst, [AI Agent empowering higher autonomous levels](#), uses GenAI to consolidate and orchestrate knowledge accumulated in network operations systems. It uses an AI agent to perform tasks that were previously carried out by experts.

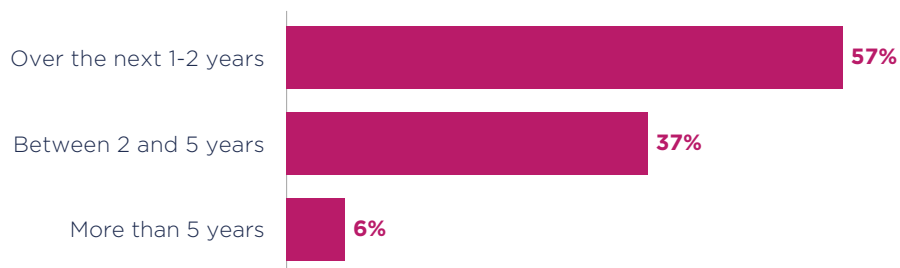
### From LLMs to SLMs

The key to GenAI adoption within CSPs is delivering better results and transitioning from LLMs which are trained on – and whose knowledge is based on – public internet data, to LLMs which deliver results based on knowledge and systems that sit within an operator's business.

As the group CIO of one large North American CSP explains, the leading LLMs in use today – and specifically OpenAI's Chat-GPT LLMs – are designed to output content from a vast library of knowledge that has nothing to do with telecoms. "These large language models can do anything and everything. They can create a Valentine's Day message; they can write code. But as telecoms operators we need to step back and say, 'do we really need all that stuff?'"

CSPs today are adopting a number of different approaches to take immense LLMs and train them for their specific purposes. The first approach has been to use prompt engineering. This is the process of understanding how to interact with an LLM to get more accurate, relevant results. It involves getting to know a model's strengths and weaknesses, experimenting, using examples and being specific about prompts and using contextual prompts.

### When do you expect that GenAI / LLMs will have a significant impact on your business?



TM Forum, 2023

**Retrieval Augmented Generation (RAG)** is the first attempt to draw on knowledge from more specific, specialized resources – in this case the telecoms operator business. It is the process of optimizing the output of an LLM by referencing a knowledge base outside of the data sources it was trained on before generating a response.

**Fine-tuning** is the process of taking a pre-trained model and making small adjustments to its parameters. It can be seen as an alternative to the costly process of training a model from scratch.

While these processes can bring about significant improvements in the accuracy of a model, the fact remains that for a CSP they still involve relying on a model that uses knowledge from outside of its business. Verizon's Arumugavelu reckons that an alternative approach would be to build small language models (SLMs) capable of addressing a specific function within the telecoms business – for example, billing. These would be much cheaper and quicker to roll out.

The trend towards smaller LLMs is one that is playing out across all sectors and verticals as businesses figure out the best way of leveraging GenAI. And the process of creating SLMs is becoming more viable thanks to the growing availability of open source technologies.

In our survey 59% of respondents said they were considering open source models in the cloud for LLM approaches, while 32% said they were considering open source on premises (see chart on the next page).

### Telecoms-centric LLMs

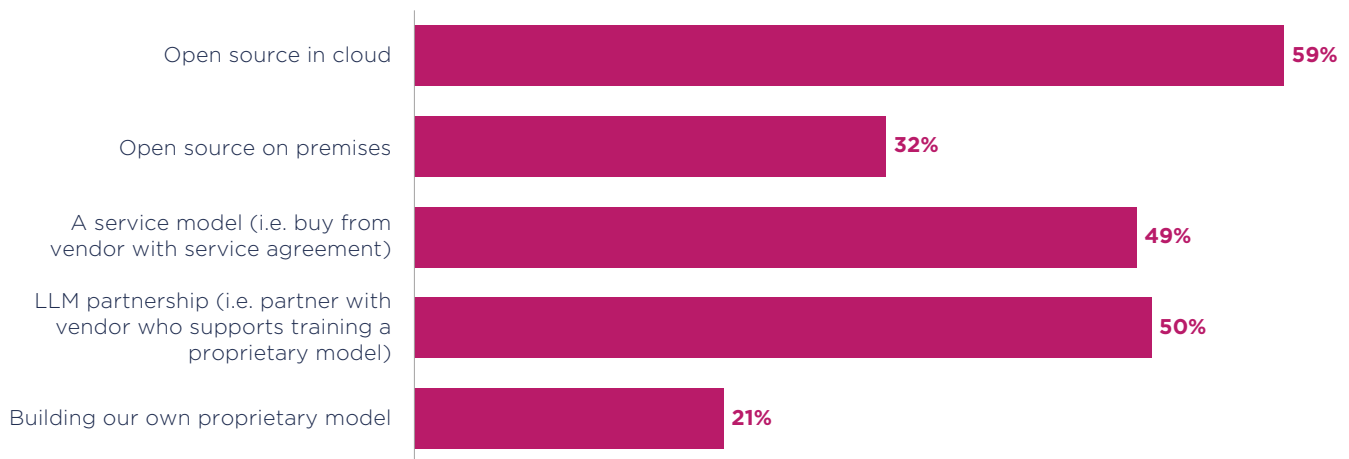
Two key initiatives – which we have already outlined briefly in this report – are aimed at producing LLMs (or SLMs) for the telecoms industry: the Global



**These large language models can do anything and everything. They can create a Valentine's Day message; they can write code. But as telecoms operators we need to step back and say, 'do we really need all that stuff?'"**

Group CIO of a  
North American CSP

## Which large language model (LLM) approaches are you considering for your organization (choose all that apply)?



TM Forum, 2023

Telco AI Alliance and China Mobile's Jiutian. It is interesting to compare the two approaches and assess other potential scenarios and opportunities for telecoms-specific LLMs.

**SK Telecom has put AI at the heart of its strategy.** It has started building telco LLMs using technology developed by its own internal team, and by three third-party companies: OpenAI, Anthropic – founded by former employees of OpenAI – and Konan Technologies.

Much of SK Telecom's work – and the focus of the Global Telco AI Alliance – is building telco LLMs that help CSPs to transform the relationship with their customers and to use this to build more value to the business. One of SK Telecom's outputs will be a telco LLM-enabled customer chatbot.

This does not mean that the Korean operator is limiting its work on LLMs to the customer experience function. The company is developing a range of LLM technologies and capabilities that address the specific needs of different functions of the CSP business.

For example, one of the important focus areas for SK Telecom is around unstructured data within the network function. "When we looked at internal source data, especially from the network operations team, we found that a lot of it was not text, it's tables or graphs, a lot of visual data," says Chung Suk-guen. As such, SK Telecom has put considerable effort into enhancing models to process and understand this rich, multi-modal data.

There is no suggestion, at this stage, that the members of the Global Telco AI Alliance will only use their own internally developed LLM(s) for GenAI-enabled use cases across the business. However, by deploying centralized platforms that capture the inputs and outputs from third-party LLMs, these operators will be able to generate training data that improves the performance of their own LLMs. Within SKT there is already AI governance in place which encourages anyone using third-party LLMs to access them via a central intelligence platform.

**The focus of China Mobile's Jiutian initiative** – what it describes as an

AI platform – is to build LLMs both for its own business and for different vertical markets. It has already built a number of different LLM models: network, customer care, traffic – all internal – medical care, IoT, entertainment and smart city. It is also working with CSPs outside China, providing them with its own AI models and LLMs.

China Mobile sees its role – in the broader GenAI value chain – as a developer of foundation models and as a partner to the systems integrators and application developers that build products for specific segments and businesses. It includes BSS and OSS systems in this application layer. The foundation model layer is trained both on China Mobile's own data and data coming in from other industries and vertical sectors. China Mobile has a team of 700 people working at this foundation model level and partnering with vertical industries on their own LLMs.

### Where do vendors fit in?

As CSPs contemplate an evolution from working with large LLMs to building or training smaller, more

specific ones, it begs the question whether they are best positioned to leverage this “niche” opportunity. As we have said, a case can be made for creating LLMs (or SLMs) for specific functions – for example, customer care or billing. But would each operator build its own SLMs to take account of differences in language, culture and choice of vendors?

Perhaps it would make more sense for a vendor in its own specific functional area to create SLMs for its own customers? Would competing vendors, anyway, be interested in partnering and creating a federated capability? Or perhaps the best approach is the one adopted by China Mobile and SKT – building foundation models and platforms and then partnering with other operators which can then customise them for their own particular requirements?

SKT is already considering the possibility of partnering with

OSS/BSS vendors. It has a vision of building capabilities within its LLM that allow it to understand and integrate the APIs from different technology vendors.

And then there are the many partnerships among vendors and IT specialists, some of which are already focused on solutions for the telecoms industry. Amdocs, Microsoft and Nvidia, for example, [announced a partnership last November](#) to create LLMs for the telecoms and media industries. Amdocs and Nvidia say they will customize enterprise-grade LLMs running on Nvidia accelerated computing as part of the Amdocs amAlz GenAI platform. The companies are exploring GenAI use cases which initially span customer care, including accelerating customer inquiry resolution by drawing information from across company data. On the network operations side, they are looking at how to generate solutions that aid configuration, coverage or performance issues.



**Perhaps it would make more sense for a vendor in its own specific functional area to create SLMs for its own customers?**

In the next section we look at whether it is possible to measure the economic impact of AI, both in terms of its effect on business functions and on financial measures such as opex and capex.

## section 7:

# measuring the economic impact of AI

It is not an easy task to measure the economic impact of AI on the telecoms industry – potential use cases are wide and varied – and market value estimates vary greatly from different sources. What is certain, is that some big numbers get touted around when forecasting the benefits of AI to the CSP business.

Those big numbers may be a function of:

- **Job cuts enabled by AI and automation.** BT estimates it could cut 10,000 jobs by 2030 by leveraging digitization and automation
- **New revenues resulting from the launch of AI-enabled products.** SK Telecom believes it could be generating as much as KRW25 trillion (about \$18.5 billion) in AI-related revenues by 2028
- Or, most likely, **the aggregation of a whole range of small initiatives resulting in cost savings or revenue increases.** [McKinsey estimates](#) that GenAI could create up to \$100 billion in incremental value for the telecoms sector (see graphic on p.42).

Later in this section we look at how opex and capex could be impacted if CSPs are able to use AI to generate cost savings. Our analysis shows the extent to which AI has the potential to create cost savings across different areas of the telco business.

As an industry the telecoms sector has consistently overpromised and underdelivered when it comes to predicting the impact of new technologies or new market opportunities. There is a near-consensus that AI could be the latest overhyped new capability, not just in telecoms but also across other vertical industries. But there is also a sense that, because it is a technology that has come from outside telecoms, expectations are less prone to being exaggerated.

## Mirroring the cloud?

As a useful exercise in setting expectations it is worth considering the impact of other breakthrough technologies in recent years. The best example is cloud adoption – private cloud and public cloud (although public cloud is, perhaps, a better point of comparison). In the early years of public cloud adoption cost savings were most often touted as the most tangible benefit. But as operators lifted applications and workloads into the public cloud many struggled to see any of those cost savings coming through.

This is not to say that operators have turned against public cloud. Rather, they see different benefits from cloud migration flowing into the business. Those operators which are taking a cloud-native approach to cloud migration – rather than lift and shift – see the benefits coming through in terms of business and architecture flexibility and scalability, the ability to make better reuse of the technology that they buy or build, and a slow but steady commitment to simplification and the elimination of technical debt.

But can any CSP truly put a financial figure on the benefits of cloud migration? Indeed, has any CSP managed to quantify the benefits of digital transformation more broadly?

In practice, new technologies help employees to do their jobs more quickly and efficiently and to start doing new and different things. This is not to say that AI – or more specifically automation – will not change and eliminate roles. But the most likely scenario is that new roles will be created as a result of the impact of deploying the new technology and the changing dynamics of the business more broadly.

We asked the CIO of one of the CSPs we interviewed as part of this research whether he thought AI would “move the needle” in terms of the revenues, costs or profitability of the business. “I am a \$10 billion business,” he said. “If you were to ask me can we generate 1% more revenues over the next three to five years from AI – that is equivalent to \$100 million – my answer would be probably not. But can I see \$100 million of savings over three or five years, over three years? Yes possibly.”

### Measuring the benefits

Most CSPs have rigorous processes in place for making the business case for investing in AI and ensuring that the benefits are realized. One of the operators we spoke to has put together what it calls a Benefit Realization Plan for Intelligent Automation. This identifies the financial and non-financial benefits for each use case.

With a basic premise that a single solution results in time being saved, the plan requires:

- an explanation of what will happen to the time that is saved once the solution is successful
- the process of value creation (taking out the cost)
- what changes (competencies and behavior) need to happen for the benefits to be realized.

When it comes to the benefits of AI, this particular operator has identified a series of categories outlined in the box below.

### How one operator is measuring the benefits of investing in AI

One of the operators we spoke to for this report identifies the following financial and non-financial benefits for each use case when deploying AI.

#### Financial benefits

##### Time saving (quantifiable)

For example, a new process could result in an 80% reduction in the time taken by a team to fulfill a specific function. It is clearly much easier to realize the benefits of automation when they result in a significant saving in one person's time than when they create small – for example 10%-20% savings – in a single role.

##### Cost avoidance (new hires)

New hires (in a legacy role) may be needed – for example, to handle increased volumes during peak periods. Automating processes may enable the existing team to handle these increased volumes. Cost avoidance could also relate, for example, to cloud computing or software-as-a-service (SaaS) where costs would normally be incurred as a result of the ingestion of poor quality data. Automated updates and validation of data quality would remove the need for such additional spending.

#### Increased revenues

In addition to the launch of new products and services, AI-enabled technologies could help an operator sell more existing products and services. A simple example would be enabling a CSP to sell more routers and boosters to both consumers and business customers by using AI technology to identify locations with poor coverage.

#### Non-financial benefits

##### Employee satisfaction

By eliminating repetitive functions – for example, the need to consult multiple sources of databases and information, sometimes providing conflicting data – AI can help employees spend more time on productive, fulfilling tasks. Most corporations run employee satisfaction surveys, so this should be relatively easy to track.

##### Customer satisfaction

There are many AI use cases which could result in better customer experience – as measured by using Net Promoter Score (NPS). An improved customer experience could result from an improved digital interface – for example, a more intelligent chatbot; swifter,

more satisfactory resolution from a call center agent equipped with more knowledge about the customer and previous interactions; or proactive guidance relating to new offers, price changes or network outages.

There is a strong case for arguing that improved customer experience drives greater loyalty and lower churn. As such, a better customer experience could be seen as delivering a financial benefit – lower churn, which can easily be measured in terms of retained revenues and lower customer acquisition costs.

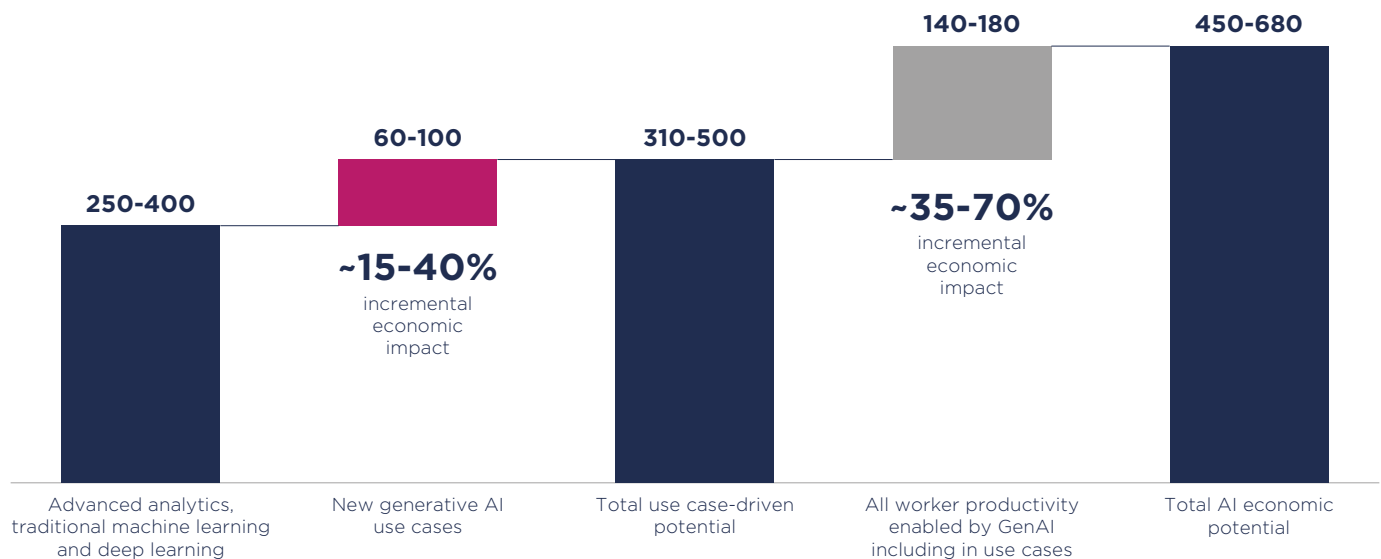
##### Time savings (small and difficult to quantify)

An automated process might, for example, result in a five-minute time saving each time a task is performed. But the process of generating quantifiable cost savings from such a task would be difficult.

##### Sustainability

An initiative to reduce energy usage – for example, by turning off different parts of the network during periods of low usage – could be measured in terms of the ensuing reduction in carbon dioxide emissions.

## Potential impact of generative AI on the telecoms industry



Updated use case estimates from "Notes from the AI frontier: applications and value of deep learning," McKinsey Global Institute, April 17, 2018.  
Source: McKinsey Global Institute, The economic potential of generative AI, June 14, 2023.  
TM Forum, 2024 (source: McKinsey & Company)

Middle East and Africa telecoms group e& has put in place a Value Realization Office whose remit is to ensure that the company can maximize the value of initiatives and investments in areas such as AI. It prioritizes different projects based on their ability to deliver on six different values including revenue generation, efficiencies, customer experience and time to market. After the use case is implemented its success is measured and monitored through techniques such as A/B testing and multivariate testing – a technique for testing a hypothesis in which multiple variables are modified.

SK Telecom has one of the clearest, most ambitious strategies for harnessing the potential of AI. It is the founder of the Global Telco AI Alliance, whose five members – the others are e&, Deutsche Telekom, Singtel and Softbank – aim to develop multilingual LLMs for their businesses. But it is also one of the operators that is least keen to target efficiency gains from its AI investments. The biggest value

that can be derived from GenAI, according to Chief AI Global Officer, Chung Suk-guen, is improving both the employee and customer experience.

### Crunching the numbers

A handful of CSPs have gone public with big financial targets for the benefits they hope to derive from AI and automation:

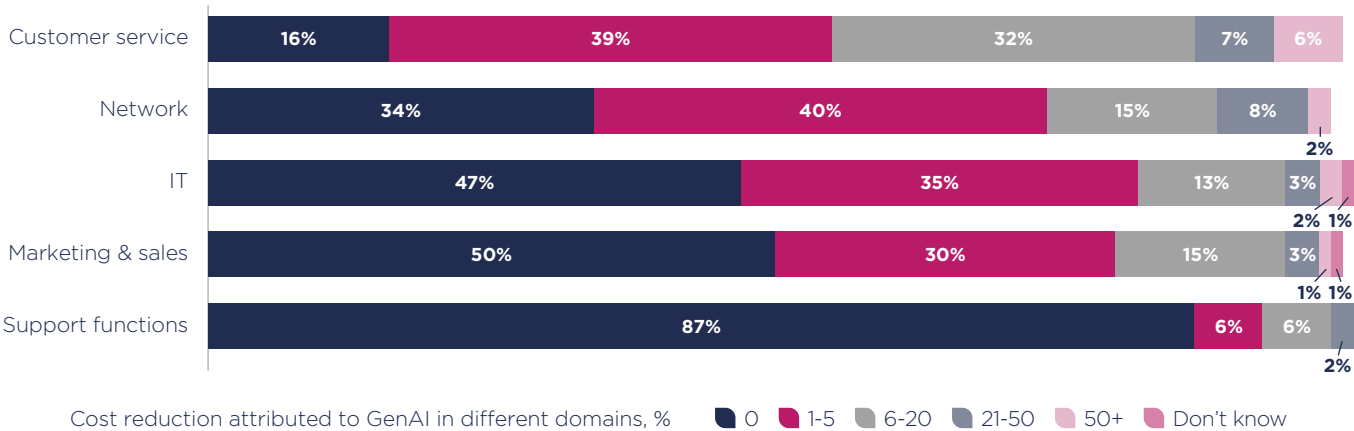
- Vodafone announced a €1 billion cost-cutting plan in November 2022. The operator says it has [already generated €500 million in capex/opex savings](#) through network automation over the past three years.
- BT is targeting £500 million annual cost savings through its digital transformation program. But it also has its eyes on [a bigger, £1 billion prize](#) courtesy of investments in new technologies such as AI and automation.
- One North American CSP that we spoke to for this

research told us it had a target of generating \$100 million in financial benefits (EBITDA gains) from AI in 2023 (equivalent to 0.5% of total revenues).

- South Korean telecoms operator [KT Corp is targeting KRW1 trillion](#) (about \$750 million) in annual revenues from its customized AI services by 2025.

Strategy consultancy McKinsey & Company has produced some extraordinarily bullish forecasts about the potential financial impact of "traditional AI" and GenAI on telcos. Some of the data and analysis that relates to the impact of analytics and traditional AI is based on updated use cases first explored in 2018. The new analysis is based on the impact of GenAI which, it says, could create \$60 billion to \$100 billion in value – it doesn't say over what period – through the deployment of new use cases and \$140 billion to \$180 billion through general productivity gains (see graphic above).

## Telcos have already cut costs using GenAI



GenAI CXO survey 2023, n=130. Question: What is the impact (% cost reduction) attributed to generative AI in the different domains? Percentages consider answers only from respondents claiming to have achieved impact and to have had at least some use cases in execution; figures may not sum to 100% because of rounding. TM Forum, 2024 (source: McKinsey & Company)

McKinsey surveyed 130 CSPs to gauge sentiment about the potential for GenAI to reduce costs in five different parts of the CSP business: customer service, network, IT, marketing and sales, and support functions. Respondents saw the biggest cost savings in customer service and network, with 39% and 40% of respondents, respectively, anticipating savings of between 1% and 5%, and 32% and 15% respectively expecting savings of between 6% and 20% (see graphic above).

### The impact on capex/opex

Drawing inspiration from the McKinsey survey it is interesting to look at how opex and capex would be impacted if CSPs are able to use AI to generate cost savings (see table right). Our starting point for building out such analysis is a breakdown of capex and opex for the global telecoms operator business produced by research firm MTN Consulting. For each category we have calculated its size as a percentage of total global operator revenues.

For each cost item we made our own judgment about the extent

### Potential impact on capex/opex of using AI

| Cost category, opex/ capex item              | % of total global telco revenues | Total \$ value billions |
|----------------------------------------------|----------------------------------|-------------------------|
| Global operator revenues                     | 100%                             | 1,779.80                |
| Opex                                         |                                  |                         |
| Network operations                           | 14.1%                            | 251.5                   |
| Network infrastructure                       | 8.7%                             | 154.7                   |
| Utilities                                    | 3.1%                             | 54.1                    |
| Content                                      | 6.6%                             | 117.5                   |
| R&D                                          | 0.7%                             | 12                      |
| Sales & marketing                            | 11.6%                            | 207.1                   |
| General & administrative                     | 10.6%                            | 188.5                   |
| Cost of Devices                              | 8.8%                             | 157.5                   |
| Depreciation and amortization (D&A) expenses | 18.7%                            | 332.8                   |
| Total opex                                   | 82.9%                            | 1,475.70                |
| Capex                                        |                                  |                         |
| Property, plant & equipment (PP&E)           | 16.8%                            | 299.6                   |
| Software licenses                            | 1.6%                             | 29.08                   |
| Total capex                                  | 18.5%                            | 328.7                   |
| Total opex plus capex                        |                                  | 1,804.30                |

TM Forum, 2024

## Potential (long-term) impact of AI on capex/opex

| Opex / capex item                            | Impact of AI     | Bullish target % reduction | Impact (\$ billions) | Bearish target % reduction | Impact (\$ billions) |
|----------------------------------------------|------------------|----------------------------|----------------------|----------------------------|----------------------|
| Network operations                           | Transformational | 20.00%                     | 50.3                 | 5.00%                      | 12.6                 |
| Network infrastructure                       | No impact        | 0.00%                      | 0.0                  | 0.00%                      | 0.0                  |
| Utilities                                    | Big impact       | 10.00%                     | 5.4                  | 2.00%                      | 1.1                  |
| Content                                      | Small impact     | 2.00%                      | 2.4                  | 0.50%                      | 0.6                  |
| R&D                                          | No impact        | 0.00%                      | 0.0                  | 0.00%                      | 0.0                  |
| Sales & marketing                            | Big impact       | 10.00%                     | 20.7                 | 2.00%                      | 4.1                  |
| General & administrative                     | Moderate impact  | 5.00%                      | 9.4                  | 1.00%                      | 1.9                  |
| Cost of Devices                              | No impact        | 0.00%                      | 0.0                  | 0.00%                      | 0.0                  |
| Depreciation and amortization (D&A) expenses | No impact        | 0.00%                      | 0.0                  | 0.00%                      | 0.0                  |
| Property, plant & equipment (PP&E)           | Moderate impact  | 5.00%                      | 73.8                 | 1.00%                      | 14.8                 |
| Software licenses                            | No impact        | 0.00%                      | 0.0                  | 0.00%                      | 0.0                  |
| <b>Total opex/capex saving</b>               |                  |                            | <b>162.0</b>         |                            | <b>35.03</b>         |
| <b>Saving as % of total costs</b>            |                  |                            | <b>9.0%</b>          |                            | <b>1.9%</b>          |

■ No impact
 ■ Small impact
 ■ Moderate impact
 ■ Big impact
 ■ Transformational

TM Forum, 2024

to which AI has the potential to create cost savings. We created five separate categories: transformational, large impact, moderate impact, small impact and no impact (see table above).

### Transformational impact

We believe that AI and automation will have a transformational impact on network operations, the total cost of which has been increasing slowly in recent years as operators have built out new networks and technologies and traffic levels have grown. However, network automation and the slow evolution to autonomous networks will transform network operations over the next five to ten years.

### Big impact

Utilities and sales and marketing will both benefit considerably from AI. The majority of utilities costs are from energy required to operate telecoms networks. But AI is already making huge strides in helping operators to optimize their energy consumption.

Sales and marketing includes customer relationship management (CRM) and customer experience, which is the biggest single focus of CSP investment in GenAI. There are many other use cases across predictive AI and GenAI within the broader sales and marketing category which enable operators to gain more granular insights into customer sentiment and intent and deliver more targeted offerings.

### Moderate impact

General and administrative expenses (G&A) is not a part of the business where you might normally expect a major impact from the deployment of a new technology. However, GenAI in particular has the potential to automate many processes and functions across the organization. Furthermore, functions such as HR and finance, which are necessarily document- and data-heavy, could see significant improvements in productivity through the use of capabilities such as copilots.

Property, plant and equipment (PP&E) capex mainly comprises the network itself, both passive and active infrastructure. AI is already helping operators to better

plan and optimize their networks, and it will also become central to the functioning of the network.

### Small impact

The content category comprises spending on content for services such as operators' pay-TV businesses. There may be some small savings available to operators by using AI to better meet customer needs and tastes.

### No impact

We were unable to identify potential benefits of AI to the categories of network infrastructure, operating expense elements (spectrum, interconnection and rental / leasing), spend on devices (smartphones, routers and so on), depreciation and amortization (D&A) or software licenses.

By allocating a percentage cost saving for each of the five

categories we were able to assess the total overall saving to the \$1.8 trillion CSP business. We identified a bullish and a bearish percentage cost saving for each category in order to show a range of potential cost savings. In a "bullish" scenario total capex and opex falls by 9.1% from \$1.8 trillion to \$1.64 trillion. A "bearish" scenario sees a 2% decline to \$1.77 trillion.

Based on this analysis, AI has the potential to deliver cost savings of between \$35 billion and \$162 billion to the global CSP sector. However, these numbers should not be taken as forecasts. Rather, it serves as a context in which to consider the potential cost-saving benefits of AI and, at the same time, a challenge to the industry to ensure that benefits are realized.

In the next section we look at the future of AI and how it could be applied to telecoms markets.



**AI has the potential to deliver capex/opex cost savings of between \$35 billion and \$162 billion to the global CSP sector.**

## section 8:

# the future of AI technology

Last year was a tipping point for the use of AI, not just in tech industries but across most verticals the world over. By February, OpenAI's ChatGPT had become the [fastest growing app of all time](#), and by year end GPT4 had started to erode Google's dominance as a search engine. It had added image creation capabilities and become a shortcut for millions of repetitive tasks.

In 2024 everyday life has already changed due to this technology. From students being asked to do their homework at school without access to devices, to software developers refining code, there is no putting the AI genie back in the bottle. But where is this journey leading us?

The success of GenAI, and specifically ChatGPT, gave a

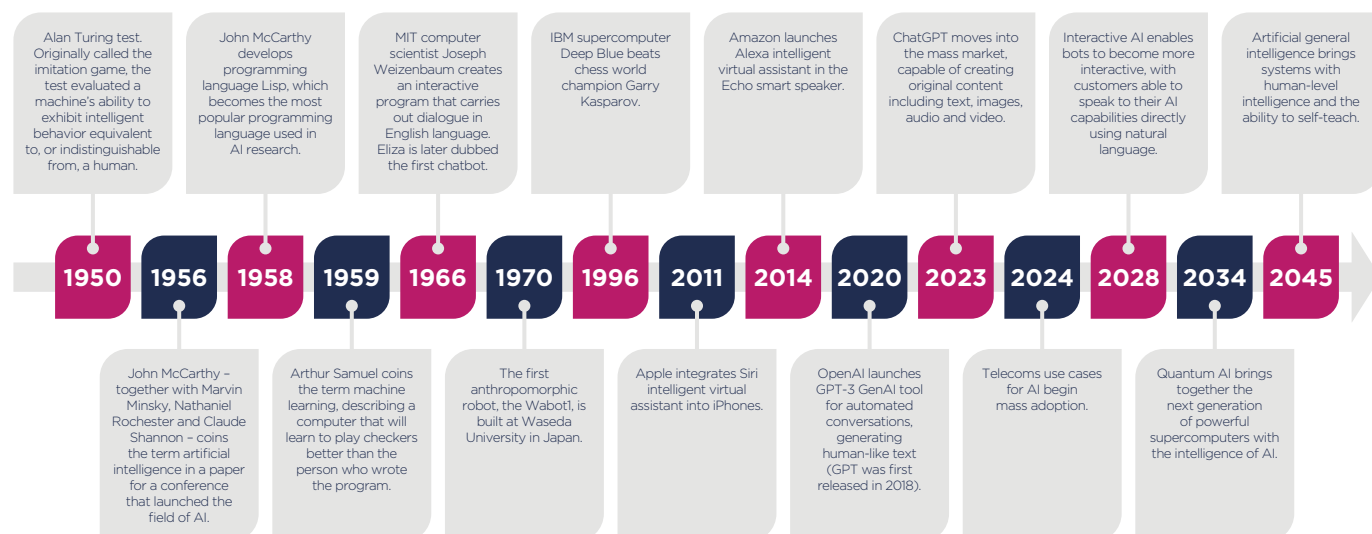
sudden boost to the progress of AI, which has been on a steady evolutionary path for several decades. We are now in the grip of huge global hype surrounding the technology, with exponential growth predicted for several years.

### Developmental milestones

From the coining of the term in 1956 by John McCarthy of MIT

and colleagues, to the present day boom in both adoption and development, AI has had a long and chequered history. Its progress has tracked the rise in computational power as progressively more complex computing hardware and more advanced software systems have provided an increasingly more capable environment for AI systems (see graphic).

## A selected timeline of artificial intelligence development



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TM Forum, 2024

In the future, AI's impact will be felt across many industries to differing degrees. Telecoms will be one of the verticals that will see the most significant impact compared to similarly sized, tech-heavy and closely regulated industries, as we show in the graphic.

In addition, some predictions being made in other industries about the future of AI adoption may have a bearing on the telecoms industry's own roadmap. GenAI may well give way to interactive AI as a focus of our collective interest; the rise of quantum computing may supercharge the AI evolutionary arc; and artificial general intelligence (AGI) could be the point at which machines become as intelligent as humans.

Towards interactive AI

Generative AI's powering of chatbots is remarkable for its ability to gather and contextualize data which can perform customer service tasks better than an FAQ table. Personal digital assistants like Amazon's Alexa have been around for more than a decade, but they are still just fixed

responses to simple commands. However, the next phase is for those bots to become more interactive, with customers able to speak to their AI capabilities directly using natural language and engage in a more human-like conversation.

Google DeepMind co-founder, Mustafa Suleyman, believes the future of AI assistants will be in their ability to interact with humans as though they were another person. "The third wave will be the interactive phase," Suleyman [told MIT Technology](#)

[Review](#) last September. "That's why I've bet for a long time that conversation is the future interface. You know, instead of just clicking on buttons and typing, you're going to talk to your AI."

The implications of this development for telecoms and other industries could be centered around customer service touchpoints as we have seen for GenAI, but it could also be much deeper from an enterprise IT perspective. As teams within a business work at computers, each interacting with a centralized AI, it could have a multiplier effect on productivity.

Queries and requests to colleagues could be eliminated, reducing email traffic, with a quick question to a contextually aware corporate AI providing the answer and a series of suggestions of how best to proceed. Within a decade the whole nature of working in an office environment could be changed. Indeed, having human-parity intelligence built into these systems would be the equivalent of adding additional workers, which is the goal of companies driving towards AGI.

“Artificial general intelligence (AGI) could be the point at which machines become as intelligent as humans.”

## Quantum computing

The developmental timeline for AI is on a collision course with that of quantum computing, with the two likely to start hitting their true potential towards the beginning of the 2030s. As such they will likely form key components of a quantum AI (QAI) which is greater than the sum of its individual parts: Quantum computing will provide the pure speed and number crunching, while AI will be the intelligence in need of more powerful processing.

Quantum computing is a future mode of computing which leverages the properties of some quantum particles and quantum mechanics to produce computers able to solve complex problems much faster than those of today. They are particularly suited to certain kinds of problem solving, such as running extremely complex simulations or constructing dynamic optimization strategies for complex systems. As such, their potential use in telecoms network management is much anticipated for network digital twins, planning and dynamic network optimization.

Adding AI to the quantum mix brings contextual intelligence to the brute force power of the new wave of machines. The years of customer, IT and network data that telecoms companies have stored, but do little with, will be fuel for QAI, which will be able to



**It is not difficult to imagine a future where the BSS/OSS and network management system ecosystem we know today is totally replaced by a single operations platform powered by a quantum AI engine.**

analyze billions of parameters to drive ideal-world business and customer outcomes.

This technological synergy may also be the inflection point for use cases like the metaverse, which has not lived up to its hype. QAI will also likely form the next generation of computing infrastructure for many existing technologies. It is not difficult, for example, to imagine a future where the BSS/OSS and network management system ecosystem we know today is totally replaced by a single operations platform powered by a QAI engine.

## Smarter than humans

In recent months several large technology company CEOs, including [Meta's Mark Zuckerberg](#) and [Nvidia's Jensen Huang](#), have speculated that AGI is less than five years away. AGI is a theoretical future branch of AI that will attempt to create systems with human-level intelligence and the ability to self-teach. The ultimate aim is for AGI software to be able to perform tasks that it is not necessarily trained or developed for, instead of being limited to a specific scope. In this respect, AGI will be the first true complete artificial intelligence that solves complex tasks with generalized human cognitive abilities.

The societal impact of such capabilities could be huge. With AGI set to perform tasks that we do today, it potentially hails the start of the era of AI systems that are smarter than humans.

Computer scientist Geoffrey Hinton, noted for his work on artificial neural networks and who left Google last year to speak freely about the dangers of AI, told CBS News last year: "Until quite recently, I thought it was going to be like 20 to 50 years before we have general-purpose AI. And now I think it may be 20 years or less."

## section 9:

# Key findings and recommendations

In this report we have focused on the opportunities and challenges to CSPs implementing strategies to deploy AI technologies throughout their organizations. This section brings together key findings from our research and offers some recommendations for those strategies going forward. Most of those findings and recommendations are based on the interviews we conducted with 20 senior executives, with some also based on the results of our survey of 104 executives from 73 operators carried out towards the end of 2023.



## AI's impact on the CSP organization

### Key findings

- The Chief AI Officer (CAIO) role is beginning to emerge in a few CSPs, but in most cases it is the CIO or the CTO who is ultimately responsible for the organization's AI strategy. **It is common for CSPs to introduce shared responsibilities spanning technology and business functions.**
- **Skills in AI / machine learning, data analytics and automation are in high demand.** Only cybersecurity scored higher than AI in our survey when it comes to both demand and difficulty in finding the skills.
- **Many operators have set up AI centers of excellence.**

- AI has had a galvanizing effect on CSPs' ability to **bring together teams and functions from across the business to work on joint projects and initiatives.**
- We found very little evidence of operators targeting the elimination of certain job roles and functions through the use of AI in the medium term. However, **many CSPs do see AI as playing a key role as and when technical and operational staff retire.**

### Recommendations

- **The roles of an AI center of excellence should include:** a) **creating AI tools and guides** to enable teams across the organization to start developing their own use cases; b) **establishing rules and guidelines** (AI Governance); c) **ensuring that**

**the business has a means of capturing AI usage across the organization** to help feed into its own learning / training; and d) **setting up skilling and reskilling programs.**

- As CSPs aim to democratize access to AI tools and capabilities across the organization, **centers of excellence should evolve into centers of enablement.**
- **By focusing on the use of AI to address issues relating to staff retirement CSPs may have the opportunity to automate functions and systems,** and to reallocate work and responsibilities, rather than replacing some roles. GenAI can also play a role in helping to train less experienced teams on the specialized skills required by staff that are retiring.



## Getting the right data foundations in place

### Key findings

- **Fewer than half the respondents in our survey considered that they were doing a good job making use of structured data.** This is precisely where GenAI can play a crucial role in capturing and deriving value from the knowledge that sits within, and around, the edges of their organizations.
- **Without easy access to data that sits across the CSP organization it will be extremely difficult for any operator to deploy AI at scale.**
- **Making data AI-ready is a major challenge for those CSPs which keep data in multiple data lakes** across the organization and in a combination of public and private cloud environments.
- **CSPs are at the early stages in terms of trying to figure out how their commitment to the principles of openness and composability** in their IT systems – and perhaps in future in their networks – **shapes their choices** in terms of the AI models that they deploy in use cases across the organization.
- **The heavy dependence on partnering with hyperscalers for GenAI services may create problems when it comes to use cases that present privacy and security issues** – which might be the case with many use cases involving the network. As such, CSPs are exploring options for how to use hyperscaler capabilities while keeping their data on premises. However, as things stand **there appear to be no**

**easy options for using the public cloud for use cases that require large-scale access to network data.**

### Recommendations

- The use of unstructured “knowledge” within CSPs represents a huge opportunity for deploying GenAI. However, **CSPs need to put the first GenAI use cases into production – and to get good results – before attempting to build a data structure and strategy around such data.**
- **Building a data fabric or a data ocean** – a public cloud environment where data can be accessed quickly and easily – **is an essential foundation for deploying AI at scale.** For those operators which continue to retain a patchwork of data lakes across public and private cloud environments, the next best option is to deploy multiple use cases in a specific functional area simultaneously.
- If operators are to fully leverage AI across their entire organizations, and to run models, gain insights and automate processes that sit between different systems and functions, **they will need to build a taxonomy – or rather an ontology – that defines how these systems and functions relate to each other and the dependencies between them.**



## Benefits, KPIs and getting a return on investment

### Key findings

- The **costs so far incurred by CSPs in their AI deployments mainly comprise buying services / solutions for specific use cases** – such as energy saving in the network – and the teams they have built

in readiness for ramping up AI deployments. Computational costs have been modest.

- CSPs are only at the very early stages of considering how and where to use AI to build new products and services. However, **AI will play a crucial role in solving the complex network and service operational issues that must be addressed to deliver revenues from concepts including NaaS, network slicing and API monetization.**
- **The cost of experimentation with GenAI today is low,** because of the business model of LLMs which scales directly based on usage (tokens). However, **cost does become a consideration when operators start to deploy at scale.**
- **Operators are significantly increasing their spend on public cloud service providers** which are now offering licenses for copilot services.
- **There is a risk of incurring technical debt** through the uncontrolled purchase and deployment of different AI models and services across the organization.
- Our analysis of CSP capex and opex presents **two scenarios for the potential savings that could result from the successful use and deployment of AI.** In a “bullish” scenario total capex and opex falls by 9.1% from \$1.8 trillion to \$1.64 trillion. A “bearish” scenario sees a 2% decline to \$1.77 trillion. However, it is worth noting that when CSPs first started to embrace public cloud services many thought it would lead to significant cost savings. This is not how public cloud deployment has played out and **there is every prospect that AI, similarly, could fail to deliver anticipated cost savings.**

- **Operators which own networks in many countries are being frustrated in their attempts to replicate similar use cases across different regions.** In many cases, they use different vendors for different parts of their business in each country and they are unable to replicate a use case from one region to the next.

### Recommendations

- **CSPs should make every effort to learn approaches and techniques for minimizing spend on LLMs,** even though the costs they are incurring today are modest. When use cases go into production LLM costs will soar.
  - **An AI governance program needs to be put into place to reduce the risk of incurring technical debt** while, at the same time, encouraging usage and experimentation.
  - **CSPs must start to deploy FinOps for AI as they start to scale AI deployments** and open access to AI tools to teams across the organization.
  - **CSPs should embrace the principles of openness and composability in their deployments.** If they don't, decisions made today in terms of how they use AI within their organizations risks leading to technical debt in the future.
- GenAI although **many of the feasibility analyses we have seen include head-count savings as the key benefit.**
- **Most CSPs will likely use multiple LLMs in order to avoid lock-in, get the best value and ensure that they benefit from new technologies and capabilities.** This will, however, incur higher costs in terms of training, fine-tuning and so on.
  - **Many CSPs are now looking to build platforms that sit above the LLM(s)** and which capture inputs and outputs to use this for their training.
  - **There is a trend towards the use of smaller, more specialized LLMs,** sometimes referred to as small language models (SLMs). However, it is still unclear whether these will be developed by each operator, by a group of operators or by technology vendors.
  - **GenAI is not, as things stand, a technology and a capability for replacing people.** Rather, it is a tool for making jobs easier, making better decisions and for creating time to perform more valuable tasks.
  - **Most LLMs today are trained on text.** However, much of the data coming out of the networks organization comprises chart and graphical representations.

### Recommendations

- **Operators should not create a dependency on a single LLM.** They need to avoid lock-in and have access to the latest versions.
- **CSPs need to capture all the learnings, inputs and outputs from LLMs** across their organizations and feed it back into their training and future strategies.

- As part of their evaluation process for putting LLM-enabled use cases into production – and to ensure that costs do not exceed the benefits – **operators need to carefully evaluate:** a) **the opportunity cost of waiting until the accuracy of the LLM gets close to 100%;** b) **the development time to implement use cases commercially;** and c) **the “service” cost of deploying the use case,** which can be significant if it is deployed at scale.
- If CSPs are to use GenAI to exploit the graphical and non-text data that comes out of their network organization, **the LLMs that they use will need to evolve from unimodal – where they are only able to take one type of data as an input and generate the same type of output – to multimodal** where they receive multiple modalities of input and generate multiple types of output.

**For a more detailed exploration of GenAI, and our findings and recommendations for using the technology, read our report:**



## GenAI's impact on CSPs

### Key findings

- **An improved customer experience and better productivity are seen as the main benefits of deploying GenAI.** Operators are reluctant to be drawn on the (opex) efficiencies that might be possible through the use of

# additional features & resources

## **Sponsored features**

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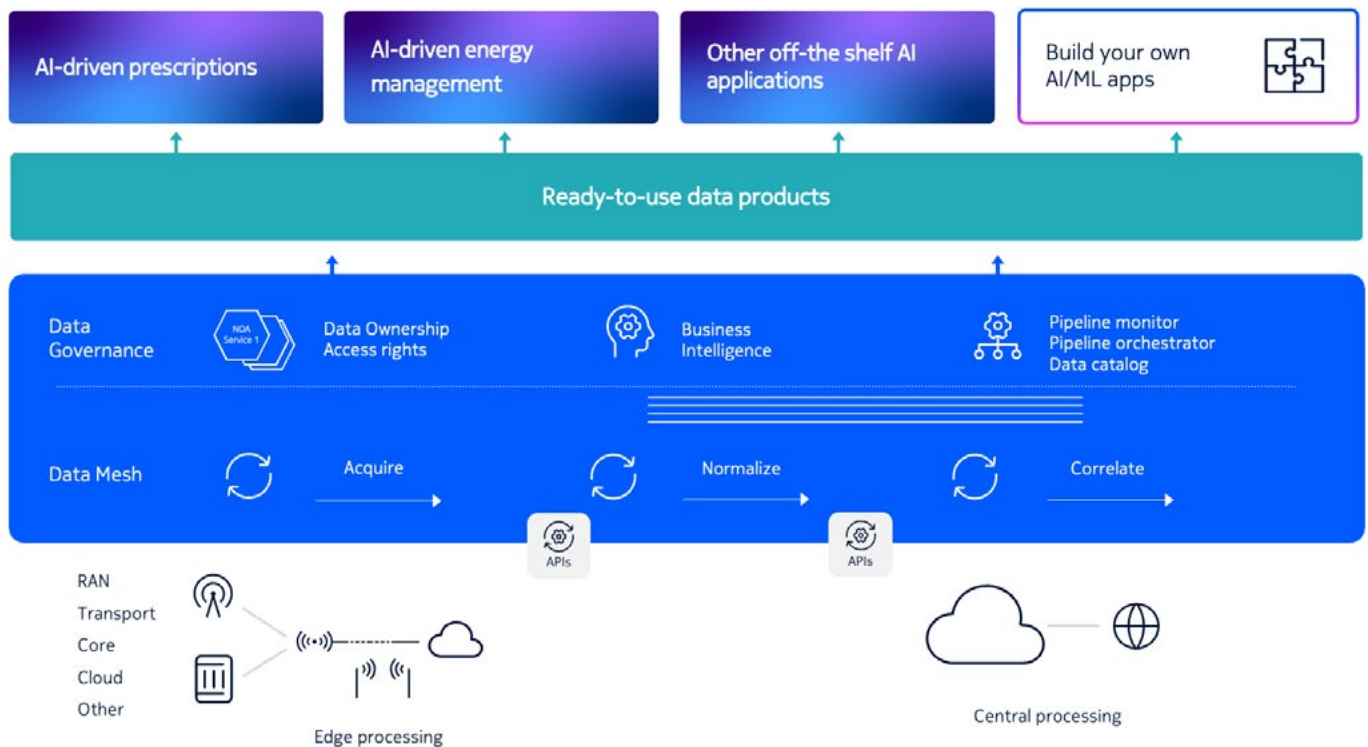
NOKIA

## A co-existence story: GenAI needs to be built on a solid data foundation and should leverage traditional AI

Statement of the obvious: Generative AI is a game-changer for communications service providers (Duh!!!). It not only speeds up knowledge discovery and content generation but can also be applied to a wide range of tasks such as service assurance, network slice design and security operations.

But to achieve the goal of Level 4 and Level 5 autonomous operations communications service providers (CSPs) will also need to leverage traditional AI capabilities. Traditional AI, which includes classical supervised, unsupervised machine learning, and reinforcement learning, has proven effective in handling structured telemetry data like time-series and tabular data. It's been successful in use cases such

as anomaly detection, delivering highly accurate outcomes. In contrast, GenAI excels in extracting knowledge from a wide range of unstructured data. Today, GenAI focuses primarily on natural language with multimodal enhancements and it's best suited for complex but non-real time automation tasks, acting as an AI assistant, augmenting the human decision-making process. Furthermore, to avoid GIGO (Garbage In, Garbage Out) any AI model must be built on a solid foundation of curated data. CSPs generate a vast amount of heterogeneous data daily, but gathering and preparing it is a time-consuming and challenging task – something which is highlighted in TM Forum's latest AI benchmark report.



### A suite of ready-to-use data products to accelerate AI use case development

Nokia offers a catalog of readily available and proven data products (see chart above) specifically designed to expedite business insights and enable AI at scale for autonomous operations. These standardized data models eliminate complexity and reduce the time required for data preparation, allowing data scientists to accelerate the development of new AI/ML applications.

The data products are built by ingesting, and correlating data from multiple data sources across multi-vendor, multi-domain networks. This is enabled through multi-vendor adaptors and a library of automated data transformation services. Nokia AVA Data Suite efficiently extracts real-time telco data from the network onto a data mesh architecture, ensuring democratized and secure access. With our reusable data products,

CSPs can complete the data preparation process in just 3-4 weeks – a remarkable 70% faster time-to-value compared to typical projects, which can take four months or longer to accomplish.

### Off-the-shelf AI applications

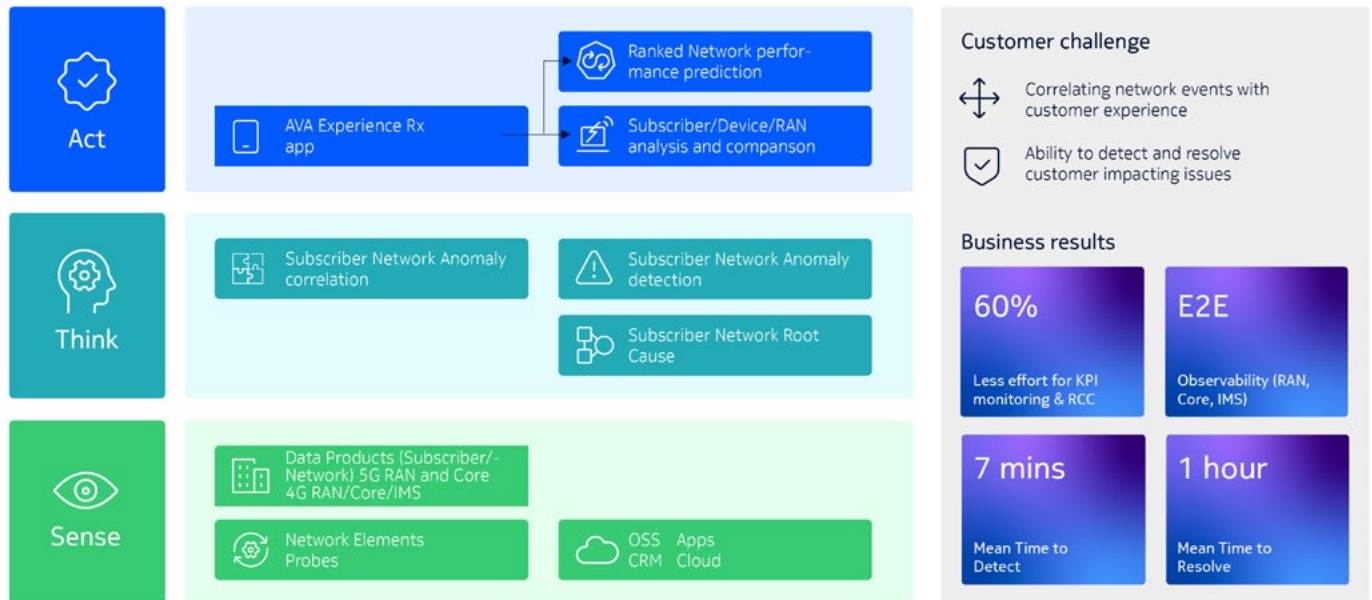
Nokia AVA also provides a range of AI applications that deliver real results, and solutions to CSPs' most important business challenges. For instance, our AI-driven prescriptions solution uses machine-learning to provide prioritized recommendations to enhance user experience for CSPs' fixed and mobile subscribers.

Again, solving intricate data challenges lies at the core of our solution. Leveraging AVA Data Suite's standardized data models, we employ a consistent approach throughout. This involves initially gathering the requisite data tailored to the specific use case, followed by conducting unsupervised anomaly detection and root cause analysis.

Subsequently, we provide tailored prescriptions aimed at achieving the defined objectives for each use case in real-time, facilitating the move towards autonomous operations. Here's a glimpse of the use cases this solution enables:

- **Churn reduction:** Strategically minimize churn rates and identify revenue enhancement opportunities by accurately predicting churn instances based on historical data. This proactive approach empowers CSPs to intervene before churn occurs, ensuring sustained customer retention and maximising Customer Lifetime Value (CLV).
- **Quality of Experience (QoE) improvements (Voice/Video/Gaming/Streaming):** Elevate the QoE for end users across various applications and services. By analyzing app events and metrics, our solution identifies areas for improvement, prescribing next best actions to enhance QoE and rectify network issues promptly.

## Canadian CSP turns actions from reactive to prescriptive



- Expenditure reduction (preventing network issues or customer care tickets): Employ AI-based analysis to detect recurring patterns and facilitate early intervention on network issues. Through incident grouping and root cause identification based on spatial and temporal proximity, CSPs can proactively mitigate potential disruptions, thereby reducing operational costs.

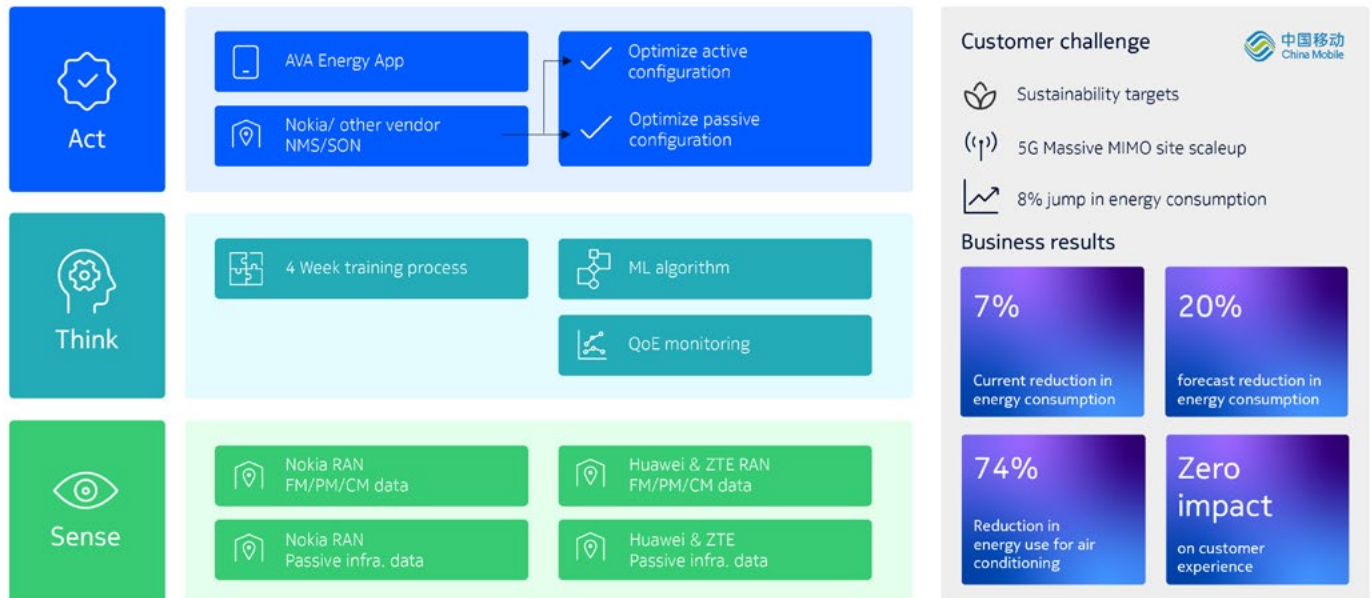
Our AI-driven prescriptions cater to a wide spectrum of needs, extending support to fixed, fixed wireless access, and mobile services. This functionality is presented through a user-friendly interface, designed to facilitate seamless navigation and enable effortless interaction for a variety of roles including engineering, operations, customer care and management.

### AI-driven energy management for sustainability

With rising prices and the need to reduce carbon emissions, minimizing the energy used to power network infrastructure is a critical concern. Nokia AVA's AI applications extend to AI-driven energy management, addressing this concern directly. Through intelligent algorithms embedded in our data products, we minimize power consumption in the RAN, including active elements and passive equipment such as air conditioning units. There is no dependency on vendor-specific hardware, OSS, or SON. Rigorous mechanisms provide continuous monitoring of network performance and ensure that there are no negative impacts on customer experience. Our

software saves energy based on factors such as time, location, configuration, and usage, enabling CSPs' to reduce their carbon footprint by up to 30%. We have more than 50 completed or active energy saving projects with CSPs around the world (see chart below for example).

## China Mobile slashes energy consumption with Nokia AVA



### Integrating GenAI with traditional AI

At Nokia, we are fully committed to integrating GenAI into our AI and analytics solutions. With our extensive knowledge across all network domains, proven AI leadership\*, and Bell Labs innovation, Nokia is armed with a federated knowledge source based on 30+ years of experience. Leveraging this domain and AI-modeling expertise, we are connecting today's AI capabilities with GenAI's future potential. Together, these synergistic forces will drive us closer to fully autonomous networks. Nokia has also already delivered measurable impacts with GenAI: In 2022, we partnered with a leading CSP in Asia to develop a GenAI solution designed to achieve significant gains in network and service operations. This partnership has delivered significant impacts already, including an 80% reduction

in knowledge acquisition time, a 72% increase in data analysis efficiency, and annual savings of €6.5 Million in network operations.

\* <https://appledoreresearch.com/report/solution-profile-nokia-ava-0423/>

### Conclusion: Artificial Intelligence, Real Results

Nokia AVA solutions deliver real results that address CSPs' most important business challenges. Through our readily available data products, we accelerate the AI/ML lifecycle, enabling CSPs to derive actionable insights swiftly, make informed decisions effectively, and build their own AI use cases. Our off-the-self AI applications bring our customers closer to their business objectives and the ultimate goal of fully autonomous networks. Partner with us today to realize the full potential of AI in telecom!

### About Nokia



At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

Read more about Nokia's AI and Analytics solutions [here](#).

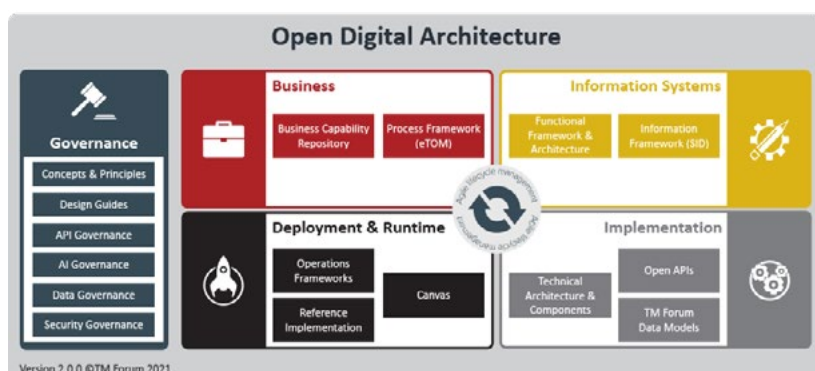
# tm forum open digital framework

## A blueprint for intelligent operations fit for the 5G era

The [TM Forum Open Digital Framework \(ODF\)](#) provides a migration path from legacy IT systems and processes to modular, cloud native software orchestrated using AI.

The framework comprises tools, code, knowledge and standards (machine-readable assets, not just documents). It is delivering business value for TM Forum members today, accelerating concept-to-cash, eliminating IT & network costs, and enhancing digital customer experience.

Developed by TM Forum member organizations through our [Collaboration Community](#) and [Catalyst proofs of concept](#), building on TM Forum's established standards, the Open Digital Framework is being used by leading service providers and software companies worldwide.



The framework comprises TM Forum's [Open Digital Architecture](#) (ODA), together with tools, models and data that guide the transformation to ODA from legacy IT systems and operations.

### Open Digital Architecture

- Architecture framework, common language and design principles
- [Open APIs](#) exposing business services
- Standardized software components
- Reference implementation and test environment

### Transformation Tools

- Guides to navigate digital transformation
- Tools to support the migration from legacy architecture to ODA

### Maturity Tools & Data

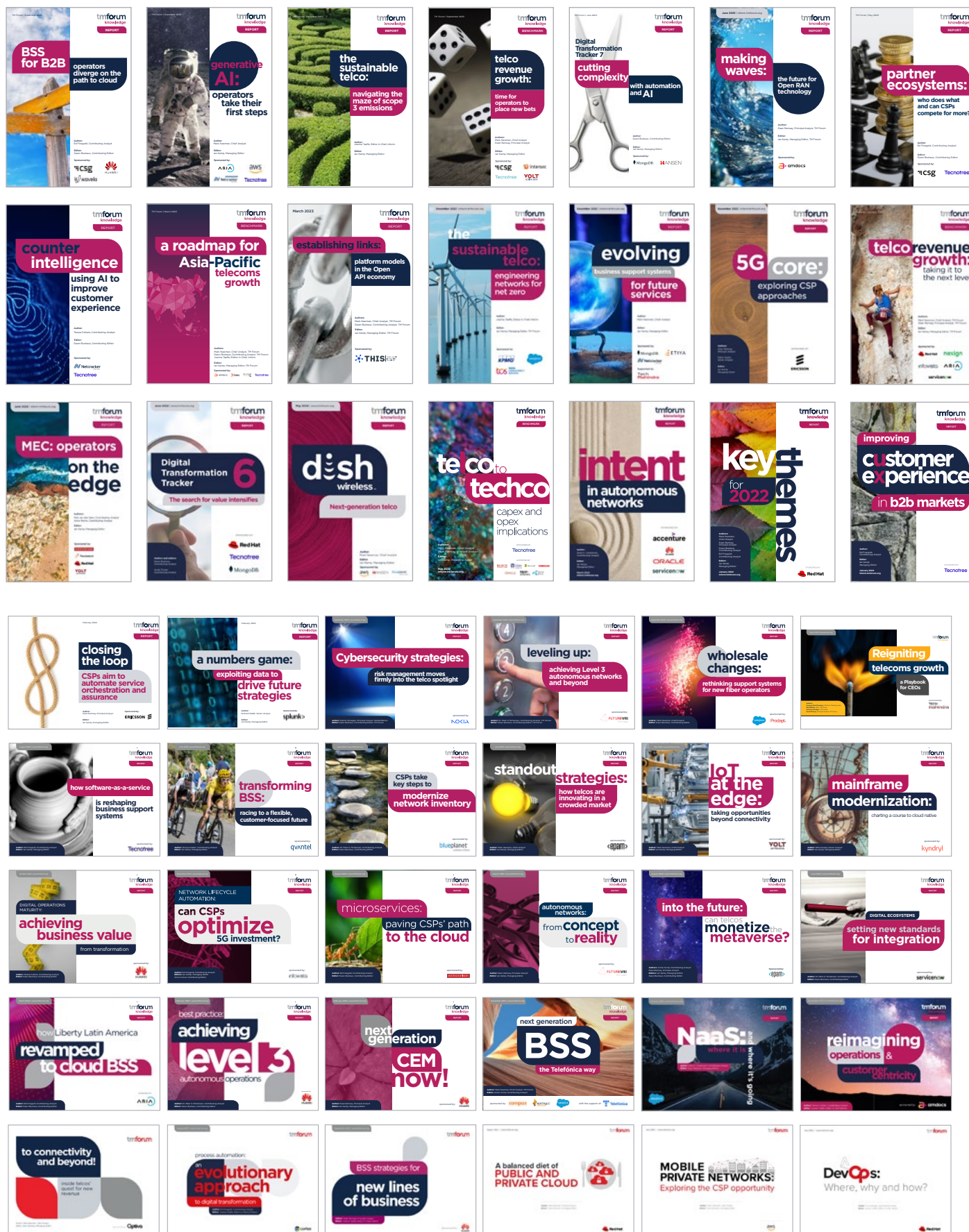
- Maturity models and readiness checks to baseline digital capabilities
- Data for benchmarking progress and training AI

## Goals of the Open Digital Framework

The aim is to transform business agility (accelerating concept-to-cash from [18 months to 18 days](#)), enable simpler IT solutions that are easier and cheaper to deploy, integrate and upgrade, and to establish a standardized software model and market which benefits all parties (service providers, their suppliers and systems integrators).

## Learn more about member collaboration

If you would like to learn more about the Open Digital Framework, or how to get involved in the TM Forum Collaboration Community, please contact [George Glass](#).



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to learn more about TM Forum's work  
on autonomous networks and AI,  
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