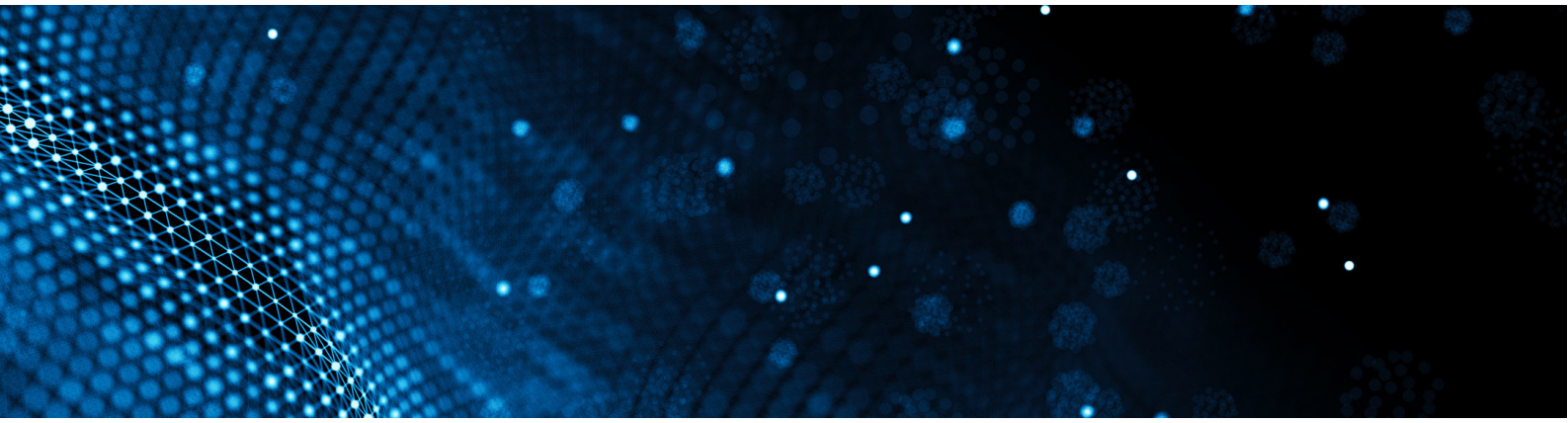
altman solon

Telecommunications Generative AI Study

September 2023

Contents

01 Introduction & Background



In the ever-evolving telecommunications industry landscape, continuous innovation is imperative to meet the demands of a digitally-driven world. As technology paves the way for groundbreaking advancements, generative artificial intelligence (AI) captures attention and interest across the telecom industry. From transforming network management to humanizing customer support and crafting personalized content, this study explores where possibilities meet reality.

The telecommunications sector presents one of the richest case studies of generative AI usage. Leveraging vast amounts of available data while navigating regulatory and technology challenges makes it a compelling candidate for exploration and implementation:

1. **Vast Amounts of Rich Data**: The telecommunications industry generates enormous volumes of different types of data daily, including call records, network performance data, customer interactions, and more.

2. **Significant Risk with Data**: Because communication service providers handle a vast amount of sensitive data, compounded by regulations that impose strict data protection requirements, the telecommunications industry has been risk-averse with technology investments compared to other sectors despite an increasingly data-driven landscape.

3. **Legacy Technology Stack**: Communication service providers still face significant obstacles when dealing with outdated technology systems. The burden of addressing technical debt and navigating complex integrations has led to a slower modernization pace than in other industries. Gartner predicts that, by 2025, technical debt (the implied cost incurred when businesses do not fix problems that will affect them in the future) will consume more than 40% of operators' current IT budget.

While the telecommunications industry is not the sole beneficiary, generative AI thrives on large datasets, making the sector well-suited to process, interact, and derive insights from this data. At the same time, generative AI can also help communication service providers (CSPs) navigate the goals of risk, cost-efficiency, and innovation by facilitating use cases that can enhance customer experience, spur innovation, and improve operational efficiency.

To date, few early-adopter communication service providers have embarked on plans to experiment, test, and explore the potential of generative AI across multiple business functions and use cases. A major U.S. telecommunication services provider noted exploring generative AI for network optimization[1], while a European provider is feeding anonymized transcripts to create summaries and analyze customer conversations;[2] an Asia-Pacific provider uses a large language model for a chatroom experience where customers can have conversations with a generated AI character; multiple major Asian providers have announced plans to develop a multilingual large language model customized for global telecommunications firms.[3,4]

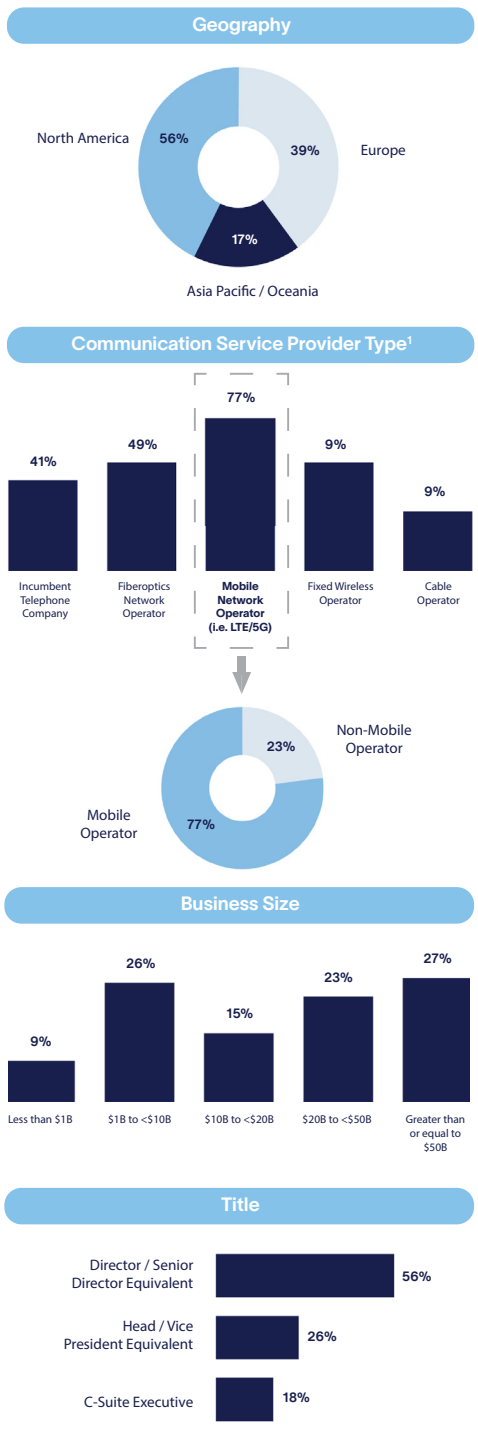
However, as the industry gravitates toward integrating generative AI, it faces its share of challenges. Telcos seek high-performance models trained on their data for specific purposes, which can be resource-intensive and time-consuming. Compliance with regulations is a priority, encompassing ethical use and user data privacy. Legacy system integration, data security, scalability, infrastructure costs, talent availability, and expertise are also areas of careful consideration.

Informed by in-depth discussions and research with telecom executives worldwide, this whitepaper delves into the myriad applications and benefits of generative AI within the telecommunications sector, how companies are approaching deployment, and the challenges that lie ahead.

02

About The Study

Exhibit 1: Respondent Demographics
% of total respondents, N = 102



AWS engaged Altman Solon, the largest global strategy consulting firm exclusively working in the Telecommunications, Media, and Technology industries, to offer insight into generative AI within the telecommunications industry. Specifically, this research seeks to understand the perspectives of communication service providers trialing and adopting this fast-evolving, innovative technology. This report aims to share new learnings and analyses on the drivers, concerns, and considerations that will impact generative AI adoption in the telecom industry.

To assess telecommunication's sentiments on generative AI, Altman Solon surveyed over 100 senior business leaders at Tier 1 communication service providers headquartered in the U.S., Western Europe, and Asia Pacific. More than 40% were C-level or VP/SVP/EVP-level executives, with the balance being Directors and Senior Managers.

Additionally, Altman Solon drew on the experience of 25 industry experts through live, anonymized, in-depth interviews to understand the relevant use cases and top concerns regarding generative AI tools of global wireless, wireline, and cable companies.

Altman Solon combines output from this new survey with proprietary insights from its recent study, Putting Generative AI to Work, from Spring 2023, which surveyed 292 senior business leaders and interviewed 21 industry experts to understand the adoption of generative AI tools for specific high-impact enterprise use cases, key considerations for development and deployment, and implications to organizations' underlying infrastructure.

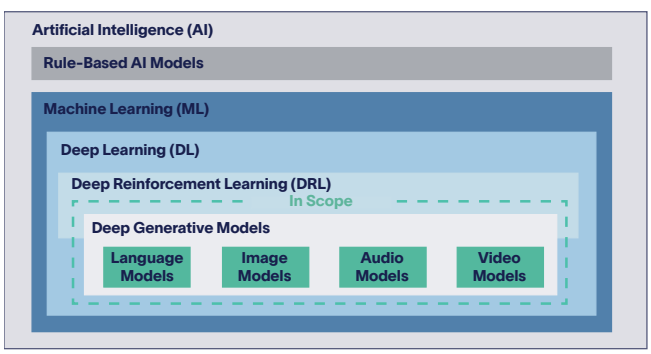
[1]MNO = Mobile Operator or CSP's who (in addition to other services) mobile network (e.g. LTE/5G) Non-MNO = Non-Mobile Operator or CSP's who are not mobile network operators but may provide other services such as fixed wireless, fiberoptics, cable, and/or telephony

03

What Is Generative AI?

Altman Solon defines deep generative models (i.e., generative AI) as a subset of artificial intelligence distinguished by its ability to create new content based on a user's prompt. While other AI models have been around longer, these existing, traditional artificial intelligence or machine learning tools (AI/ML) analyze data to enable decisions, classifications, or predictions rather than generate new content.

Exhibit 2: Artificial Intelligence Taxonomy

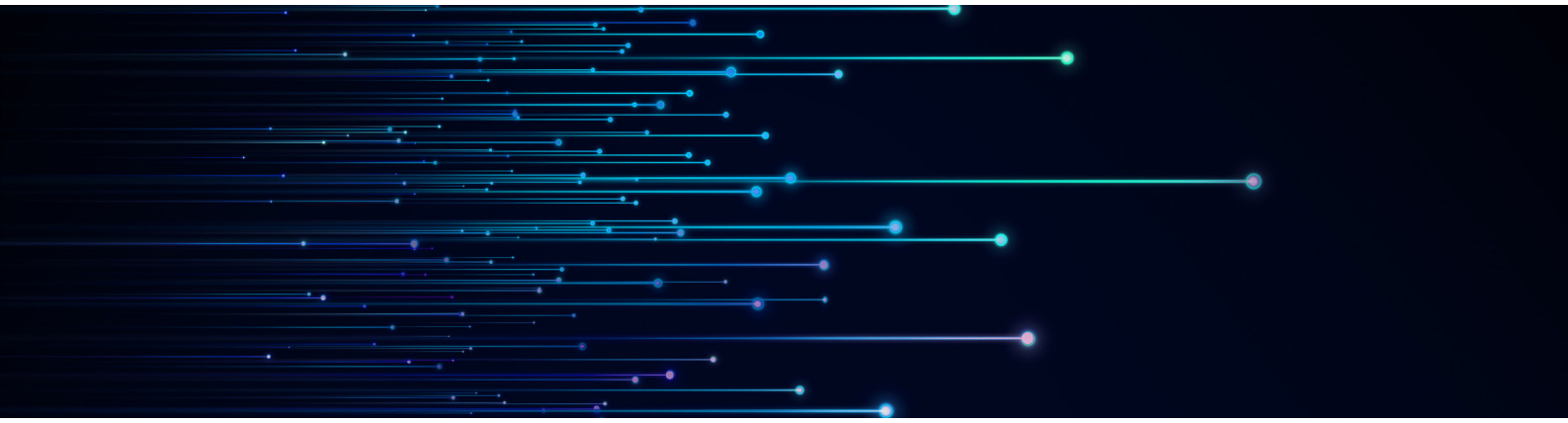


For example, machine learning models have long been used to predict purchasing likelihood, classify images into specific categories, discern the intent or sensitivity of a customer's conversation with a call operator, or provide pre-set responses based on pre-defined questions. These models all use data to "learn" and improve their output, but none aims to generate new content. Generative AI does exactly this: generate content, imitate human "chattiness" and preferences, or, even, produce quality visuals based on user prompts.

Altman Solon categorizes generative AI models by the type of content they create, including (but not limited to) language, image, audio, video, or 3D. These five different model types can be characterized by their capabilities. For example, the core capabilities of language generation include retrieving responses through search, summarization, text translation (from one language to another, including code), and autocomplete functions. For image generation, users can convert text to images or alter existing images to produce a new image. Language and image capabilities are more mature today than other generative AI models like video or 3D images. Future generative AI models are expected to be multimodal, combining various data types.

04

Key Insights & Findings



We identified several key insights as part of the study:

1. **Communication Service Providers (CSPs) see generative AI as distinct, significant incremental value on top of existing AI/ML**
   a. Seventy percent of CSPs see the incremental value served by generative AI as distinct and significant.
   b. Sixty-four percent of CSPs agree that many of the generative AI use cases being considered are new applications, not yet served by existing non-generative AI applications and processes.

2. **CSPs have kick-started their generative AI journey and while still early in their journey, some have already implemented use cases, which are now in production**
   a. The current adoption rate for the tested use cases averages at 19%. However, this number is poised to increase significantly to 48% in the next two years, indicating telcos implementing generative AI across more and more use cases.
   b. North American CSPs marginally lead adoption (average use case adoption is 21%), with Europe only marginally behind (19% average use case adoption); APAC slightly lags at 16%, given the perception of limited capabilities in non-English languages of existing generative AI models, and lower perceived data capabilities.
   c. Survey results indicate CSPs will rapidly increase their generative AI spend as much as 6x in the next two years; for instance, 45% anticipate their generative AI spend to be 2-6% of total technology spend in two years, up from less than 1% today.

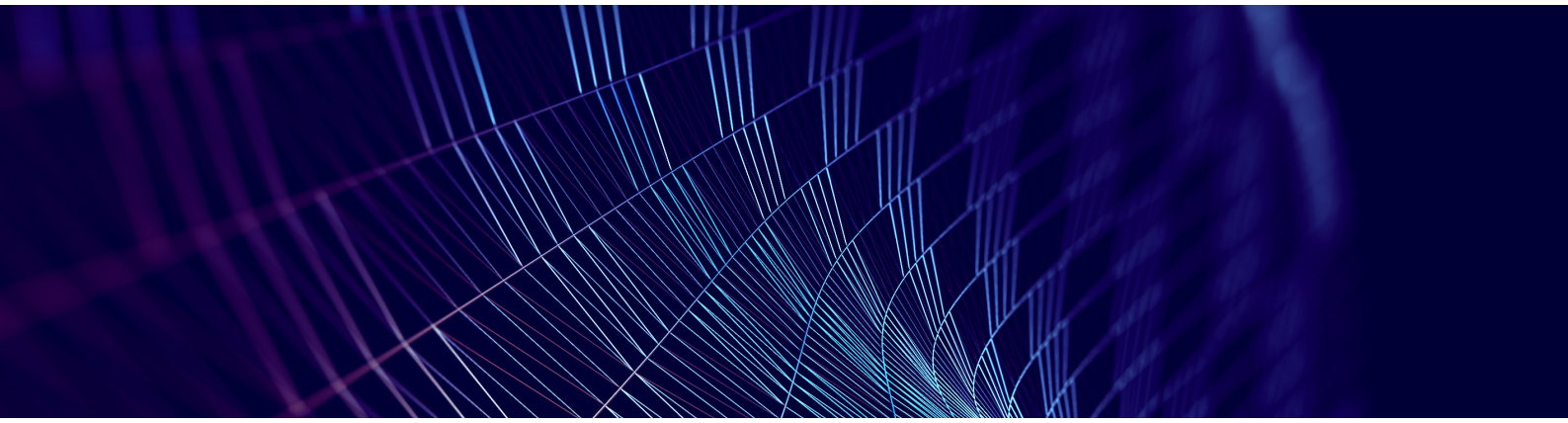
3. **CSPs are placing strong emphasis on using generative AI to enhance customer-centricity, but they primarily see it as a productivity tool**
   a. Customer chatbots are the most widely adopted use case, with 63% of respondents who selected the use case indicating it was already in production.
   b. Other use cases often focus on employee assistance, such as contact center documentation and network operations knowledge management, and are considered high business value with relatively easier implementation (Clear Wins); these are also of immediate focus, especially since these drive operational efficiencies.
   c. CSPs perceive network planning use cases such as generative route configuration and synthetic data generation for security testing as high value but are considered to have more complexity in implementation (Big Bets).
   d. More data-capable CSPs are pursuing revenue-generating use cases such as personalization and new product feature generations.

4. **Data security and governance (i.e., data management principles, policies, processes, and practices) are top challenges and critical enablers when implementing generative AI solutions**
    a. Universally, CSPs see data governance and ownership as the greatest gaps, especially given the importance of security, privacy, and regulation compliance.
    b. While data governance is a greater concern than data infrastructure, CSPs will still encounter data siloes during implementation of generative AI. Hence, CSPs will need to integrate these data siloes, which will prove to be more critical than building new infrastructure.
    c. Organizations ranking in the top 30% for data proficiency tend to perceive revenue-generating use cases as less complex to implement, signifying a higher level of readiness.
    d. More data capable CSPs leading in generative AI adoption organizationally share certain characteristics: a dedicated AI center of excellence, pervasive use of advanced data analytics, and modern data infrastructure (e.g., cloud).

5. **Most CSPs expect to use off-the-shelf models rather than develop foundation models in-house, but best practices are still being debated as CSPs learn cost-benefits of generative AI**
    a. Fifteen percent of CSPs indicated an inclination to build foundation models in-house, with the rest indicating purchasing and using off-the-shelf models.
    b. Over 65% of CSPs anticipate training off-the-shelf models primarily using their proprietary internal data to tailor them for their specific needs.
    c. The jury is still out on a universal approach to training off-the-shelf models, with most CSPs evaluating both context learning/prompt engineering (i.e., inference) and fine-tuning (i.e., training) approaches.
    d. The telecommunication sector seems to be leaning towards context learning; this technique is becoming increasingly popular as it is less resource-intensive and provides 'good enough' performance for many use cases.
    e. CSPs note the unknown cost of implementing generative AI as a top business concern; the availability of 3rd party generative AI solutions and platforms, including model-as-a-service (MaaS), are critical accelerators to adoption.

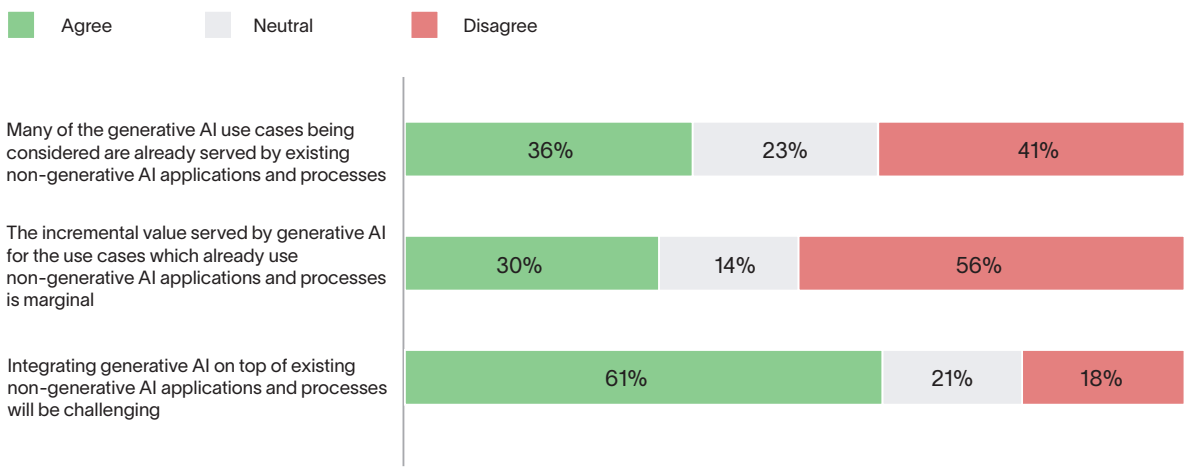
05

Overall Telecommunications Perspective



Generative AI is a new wave of artificial intelligence, and in our study, communication service providers (CSPs) affirmed interest in and adoption of this innovative technology. A majority of CSPs' executives noted using traditional AI/ML technology within the organization. Even so, telecommunications companies see generative AI as a means to create distinct, significant incremental value, even for use cases that might be utilizing traditional AI/ML. Similarly, 70% of CSPs see generative AI's incremental value as distinct and significant. Sixty-four percent of CSPs indicate these use cases as net-new and not simply a replacement for existing machine learning applications.

Exhibit 3: Communication Service Providers' Sentiments on Existing AI/ML & Generative AI[1]
% of total respondents, N = 102



[1]Please indicate your organization's sentiment on statements regarding your organization's pre-existing non-generative AI solution

> **Customer support and self-care is a specific context where generative AI can be seen as an improvement and an additional layer on top of the existing AI and Machine Learning. We've been using bots for several years now, and generative AI is a step further to help our customer care pre-assess the requests from our customers.**

Head of IT Architecture
Wireless CSP, Western Europe

Although still in the early stages, CSPs have kick-started their generative AI journey, piloting and actively implementing use cases in production. Average use case adoption is 19% among surveyed CSP respondents, and our survey indicates this will grow to 34% in the next year and 48% in the next two years.

Exhibit 4: Communication Service Provider(s) Generative AI Average Use Case Adoption[1]
% of total respondents who have implemented or are implementing a generative AI use case, N varies by region and business type respectively

37%

of communication service providers anticipate their spending on generative AI use cases to be **<4% of total technology spend in 2 years**

38%

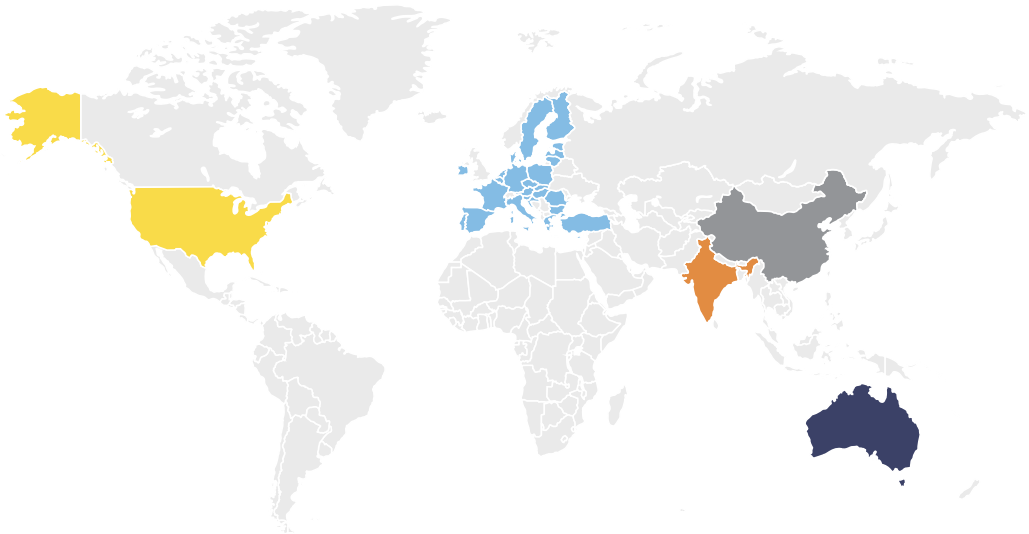
of communication service providers anticipate their spend on generative AI use cases to be **4-8% of total technology spend in 2 years**

[1]Please indicate the current stage of adoption of the following generative AI use cases within each business domain.

North American CSPs marginally lead adoption (current average of 21% adoption of tested use cases) compared to peers, potentially benefiting from from regional proximity to generative AI investments. The Bay Area has been the main hub for generative AI technology investment, attracting over $18B from venture capital and investors in the last four years, sixteen times the largest global hub outside the US (i.e., Tel Aviv $433M).[5]

European CSPs are more cautious about adopting generative AI given regional data residency restrictions such as GDPR. Particularly for CSPs outside North America, present and future governmental regulation on AI usage and data restrictions and residency continues to be a key consideration. Countries such as China and the EU are tightening AI regulation and monitoring for AI, while the U.S. and India seek a more passive approach.

Exhibit 5: Key AI Global Regulatory Considerations



United States	US lawmakers are considering potential reforms to Section 230 of the Communications Decency Act, which could require tech companies to identify and label AI-generated content. There is a proposal to establish a National AI Commission in the US to manage AI policy, as US tech companies are concerned with the strict regulations implemented by the EU and seek a more favorable regulatory environment to compete with China.
European Union	The EU's General Data Protection Regulation (GDPR) (2016) requires consent before data transfer can occur and asks that tools disclose content generated by AI. Models must also prevent illegal content generation, and AI deemed a threat to safety and rights will be assessed before widespread usage.[1]
European Union	The EU AI Act (2023) restricts AI use in products, requires safe and ethical implementation, and ranks AI systems by risk. High-risk systems require impact assessments and audits, and unacceptable risk AI, like real-time biometric monitoring and social scoring systems, being forbidden in the EU.
India	India currently does not plan to regulate the growth of AI, considering it a "significant and strategic" sector for the nation, focusing instead on fostering a robust AI ecosystem and promoting entrepreneurship and innovation in the field.
Australia	AI regulation in Australia currently is based on a voluntary AI Ethics Framework, and existing laws covering privacy, consumer protection, anti-discrimination, and intellectual property are applied to AI. In the future, Australia is likely to align its AI policy with the EU to facilitate international collaboration, data sharing, and cross-border AI deployment. This also is likely to help Australian companies comply with EU regulation.
China	China is rolling out comprehensive regulations (2023) governing artificial intelligence (AI), including measures on recommendation algorithms and synthetically generated content (deep synthesis), and strict draft rules on generative AI (AI chatbots like ChatGPT), with a goal of information control and requiring developers to make filings to the algorithm registry.

UK abides by EU GDPR policy but not the EU AI Act (currently creating similar policy for AI Use)

> The most significant pace determinant is **government regulation,** which could potentially make it illegal to build a model using customer data. This is particularly relevant in regions with **strict data regulations like the UK and EU.**

Strategy Director
Wireless CSP, USA

> Especially for **European telcos,** we are **highly cognizant of how certain data types** are deemed confidential and therefore prohibited from being used to train AI models, and **the legal restrictions on data movement under GDPR.**

Head of Data & Personalization
Wireless CSP, Western Europe

APAC lags slightly at 16% current average use case adoption despite featuring many leading CSPs looking to implement more innovative and top-line impacting use cases. According to our survey, APAC CSPs ranked their data capabilities much lower than their North American and European peers. This suggests that CSPs in the Asia-Pacific region believe they need to do more in cleaning up their data assets before they can fully realize benefits from generative AI. Additionally, APAC telecommunications executives perceive current generative AI models to be limited in their ability to handle non-English languages[6]. These perceptions may be easing through efforts such as AWS's LLM development program[7], working to help Japanese organizations planning to build their own LLMs.

> **Local languages are a factor to consider, especially in Asia.** For instance, ChatGPT is less effective in Thai than in English. Companies operating in smaller countries might need to train parts of the language model themselves to get the same effectiveness.

Head of AI
Wireless CSP, APAC

> Adoption of generative AI in the APAC & MENA region has been reported to lag due to language barriers. **Generative AI needs to be localized to understand our language and its different dialects.**

General Manager Advanced Analytics
Wireless CSP, APAC

Our study reveals CSPs anticipate a sustained increase in investment in generative AI. CSPs already adopting generative AI are allocating less than 1% of their total technology expenditure towards these capabilities. However, 45% of CSPs expect this spending on generative AI use cases to surge to 2-6% within the next two years. This suggests that CSP spending on generative AI could grow by as much as six times in the near future as CSPs scale implementations and explore newer use cases, especially as familiarity with the technology grows.

> "I assume generative AI spend as a percentage of total technology budget is small, **maximum 1% today.** However, I can see it growing through to 3-6% for big telcos.

SVP Global Systems
Wireline CSP, Western Europe

> "Of our total technology budget, around 30% is allocated to AI and data. **Within that, generative AI accounts for about 1 to 2%.** This is primarily due to many use cases being in the proof-of-concept stage and not yet scaled. Over time, I predict that data and AI will become 50 to 60% of the overall spend, and generative AI will become 30 to 40% of the overall spend.

Director of AI and Product Management
Wireless CSP, USA

Organizationally, CSPs need to navigate several stakeholders when adopting generative AI. Both CSP business domain and IT stakeholders are critical in evaluating and implementing generative AI solutions. Leaders of business function departments (e.g., customer service, marketing, network, etc.) are involved in the ideation processes for generative AI and shepherding proof of concept with other stakeholders such as legal or risk/compliance. On the other hand, IT departments have less of a role in evaluation. They are often the key owner of the generative AI use case implementation, especially around deployment choice, data implications, and maintenance and governance of the data and model. Together, these two key stakeholders determine whether generative AI has a place in the organization, and which use cases to deploy.

06

Generative AI Telecommunications-Specific Use Cases

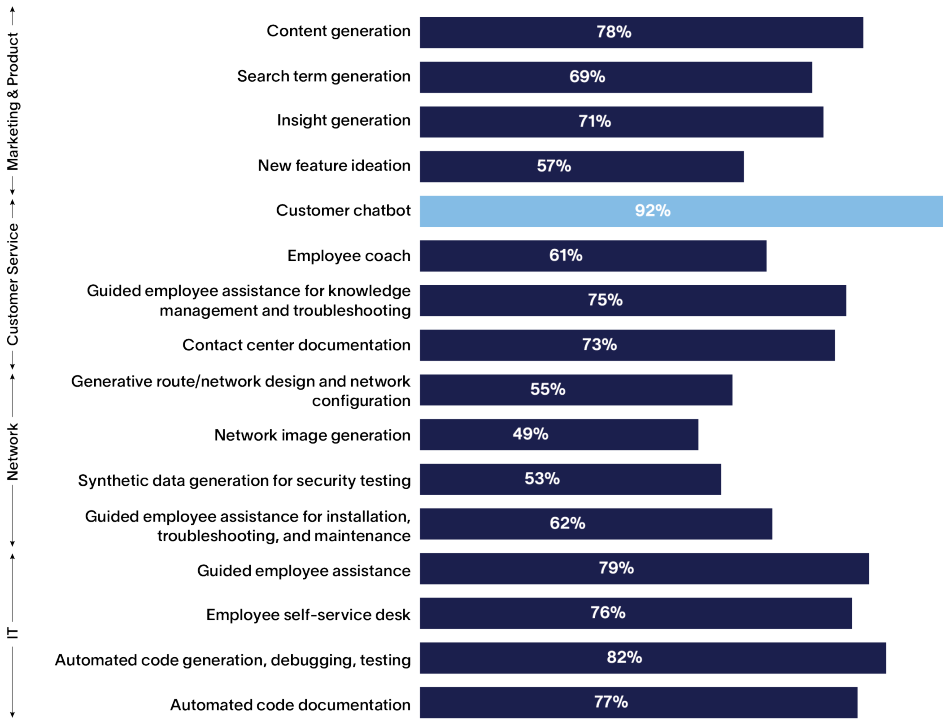
CSPs are optimistic about the potential for generative AI to create significant and incremental value. They see the technology as a means to streamline existing processes, drive innovation, create new opportunities, and unlock new sources of value in the telecommunications industry. In many of our executive discussions, the most frequently mentioned KPIs for generative AI were reduction in call volume, decreased time to resolution, and headcount reduction due to efficiency gains, though CSP executives acknowledged realization of these benefits is still developing.

> **The primary focus is on reducing the volume of incoming calls, which number in the tens of millions and are largely avoidable. The goal is to resolve these issues with a quick chatbot interaction, which would result in significant cost savings.**
>
> VP of Strategy
> Cable CSP, USA

As part of the study, we tested 17 use cases across four domains (Product & Marketing, Customer Service, IT, and Network). Unanimously across varying global CSPs, the foremost use case being actively implemented was a customer chatbot, emphasizing the paramount importance of customer-centricity.

Nonetheless, during our conversations, it became evident that these near-term implementations are limited in their transformative potential. Numerous CSPs have articulated their reliance on rule-based chatbots, previously utilizing AI/ML technologies. Executives expect to use generative AI to provide a more conversational, "chatty," human-like interaction to extend existing capabilities and features to provide information to customers, thereby reducing call volume. However, in the longer term, executives envision using generative AI to drive real-time customer action and decisions without human intervention.

Exhibit 6: CSP Generative AI Use Case by Stage of Adoption[1]
% of total respondents, N varies by respective domain



[1]% of total respondents who noted they are currently implementing & currently evaluating with high likelihood to adopt the use case

> **The primary use case [for generative AI] is providing information to customers**, enabling them to find answers independently, reducing the need for call center interactions. The next step is to use generative AI to initiate tariff changes, upgrades, or contract renewals; however, these require real-time actions and integrations. The complexity of these integrations, especially in telecom companies with many legacy systems, can be a significant hurdle. Therefore, **most early use cases are more focused on general information.**

Former Head of Data
Wireless CSP, Western Europe

> We're exploring how much intelligence generative AI can inject into these interactions and how customers might engage with it. **It's not just about pushing information to the customer;** we want to facilitate a dialogue where we can notify them of important issues, potentially ask them to make a decision and answer any questions they might have before they make that decision. We just don't know enough as to how that's going to go.

Former VP Managed Services
Cable CSP, USA

Other use cases seeing immediate traction often enable operational efficiency, such as guided employee assistance and documentation in customer service and IT. In fact, improving efficiency and productivity by using generative AI is by far the highest value driver. Forty-one percent of CSPs see generative AI as assisting employees in producing quicker and higher quality output.

Exhibit 7: Communication Service Providers' Data Capabilities[1]

% of unique responses that chose driver for use cases selected as adopted, highly likely, or interested; N varies by respective domain

Majority

	Cost Savings Automating tasks and replacing human labor / other tools	Increased Efficiency & Productivity Assisting employees in producing quicker and more quality output	Competitive Advantage Producing more revenue and offering a better end-product as opposed to competitors	Internal Employee Experience Providing a more user-friendly experience for a given process for employees	Customer Experience Providing a more user-friendly experience for a given element of the customer journey	# of Respondents Selecting Use Cases As Adopted, Highly Likely, Or Interested
Product & Marketing	8%	33%	37%	4%	18%	63
Customer Service	28%	41%	3%	15%	13%	55
Network Planning	29%	54%	13%	4%	7%	31
Network Operations	22%	49%	2%	20%	3%	41
IT Operations	27%	26%	0%	44%	1%	52
IT Software Development	22%	62%	8%	7%	1%	50
% of Unique Use Case Responses that Selected Top Driver	**20%**	**41%**	**18%**	**14%**	**13%**	

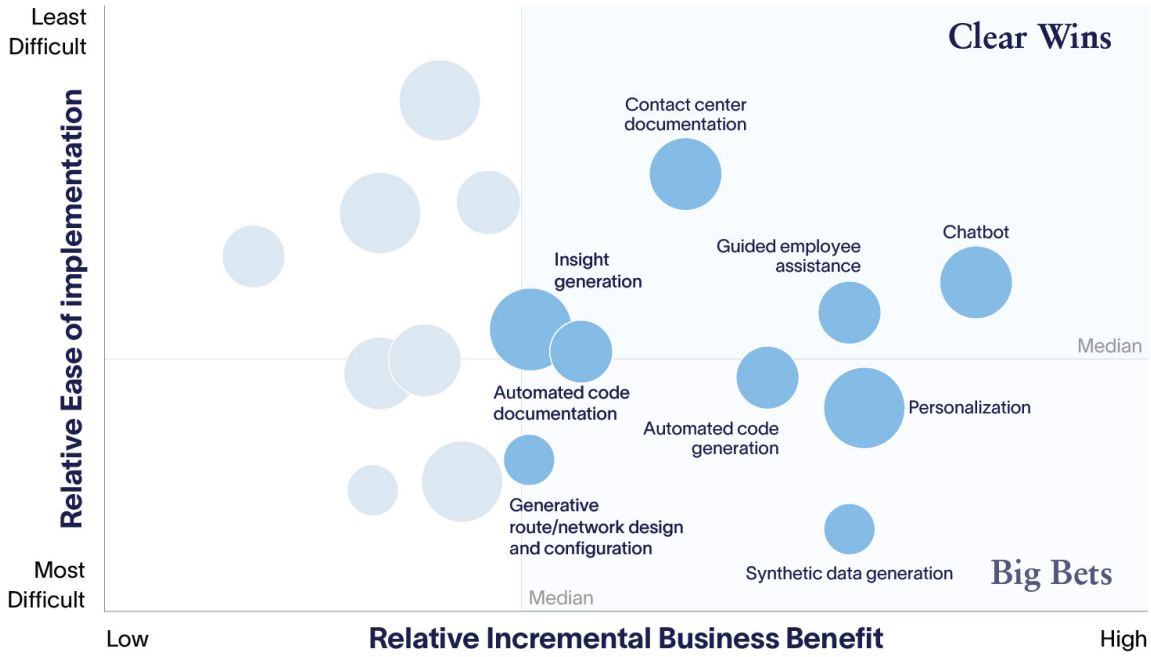
[1] Please choose the top driver for selection for each use case your organization is interested and in the process of adoption

Many of these productivity use cases are considered easy to implement and lower risk because they can largely leverage existing pre-trained, off-the-shelf models alongside existing knowledgebase and documentation to enable summarization and accessible search functions.

> **Our decision to use a generative AI tool is based purely on productivity. While it's beneficial if the representatives perform better with the tool, the primary goal is to improve their performance.**
>
> CEO
> Wireline CSP, USA

The healthy tension between business value and implementation complexity helps CSPs understand which use cases to prioritize and how fast can these be adopted. Our study highlights the nine specific high-impact use cases for CSPs, which we qualify as **Clear Wins and Big Bets**.

Exhibit 8: Communication Service Providers' Generative AI Use Cases Priority Segmentation[1]
Respondents based on median scores, N varies by use case



[1] Please rate each use case your organization is in the process of adopting by ease of implementation and incremental business benefit on a scale of 1 to 5

Clear Wins

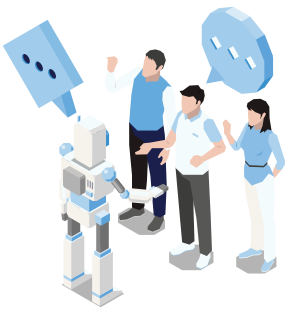
Telecommunications generative AI use cases with high incremental business benefit and less difficult implementation effort.

These use cases often focus on employee assistance, such as contact center documentation and network operations knowledge management. Of the "clear win" use cases, nearly 41% of CSPs noted increased productivity and efficiency as one of the top benefit drivers.

Network Operations

Guided employee assistance for installation troubleshooting, and maintenance

Retrieve and respond to network service engineers with information to aid in installation, troubleshooting, and maintenance network devices and infrastructure like routers, switches, and firewalls



Customer Service

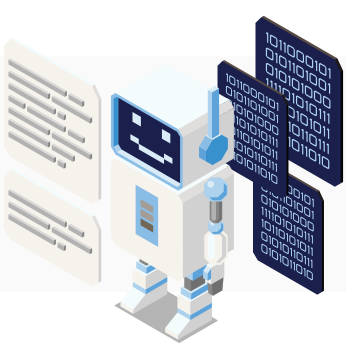
Contact center documentation

Generate transcription of calls, summarize customer interactions and suggest follow-up actions

Customer Service

Customer chatbot

Interpreting and responding to customer queries and requests in a human-like conversational manner



IT Software Development

Automated code documentation

The use of automated tools to generate documentation for code that is similar to existing documentation, often using natural language processing or non-generative AI

Product

Insight generation

Generating new customer insights to inform product enhancements and service improvements based on customer information

Big Bets

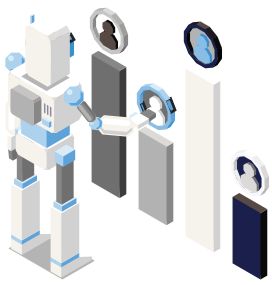
Telecommunications generative AI use cases with high incremental business benefit but more difficult implementation effort.

As noted, many of our discussions with CSP executives mentioned the potential for generative AI for network optimization, configuration, and design. However, CSPs perceive network planning use cases such as generative route configuration and synthetic data generation for security testing as **high value but more complex in implementation, and hence, not use cases for immediate adoption.**

Marketing

Personalization

Generating tailored marketing messages and content based on customer information (e.g., demographic, history, behavior)



Network Planning

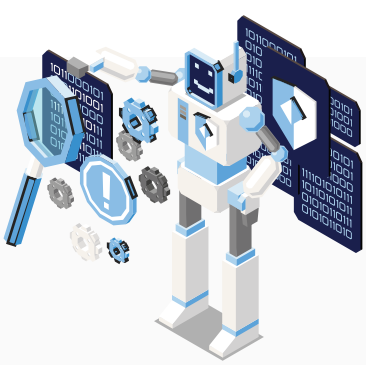
Generative route/network design and network configuration

Generate a variety of possible network designs optimized for key parameters (e.g., topography, costs, power, etc.)

Network Planning

Synthetic data generation for security testing

Artificial data that mimics real-world data, which is then used in testing security systems and identify vulnerabilities without needing to use real customer information



IT Software Development

Automated code generation, debugging, testing

The use of automated tools to create code, find and fix errors in code, and test code

Outside of guided assistance for network technicians, CSPs are hesitant to roll out network planning use cases since they involve sensitive network data. In fact, while generative AI holds promise for optimizing network planning and management, networks' complex and critical nature drives a long-term outlook on this front. One CSP executive noted using generative AI for asset management of field technicians, dispatching them before an outage occurs while en route to a scheduled preventative maintenance job.

Although network planning use cases are often regarded as significant strategic investments ("Big Bets"), our extensive discussions with CSPs have revealed a notable degree of uncertainty regarding the perceived value of these investments compared to existing machine learning technologies already deployed. For example, a large CSP in Europe mentioned that AI is already being used in network design generation. While acknowledging the potential of generative AI, they do not foresee generative AI delivering significant incremental value in this particular context.

> "We avoided network data due to its sensitive nature. Instead, we considered integrating less sensitive internal data, such as internal generic data. This approach allows us to experiment without risking significant consequences, **which happen to be often the knowledge management or productivity use cases.**

Strategy Director
Wireless CSP, USA

> "**There are numerous ideas in network planning, although none are concrete at this point.** Some examples include network design, where network designs and configurations are fed to generative AI to create more optimal or innovative designs.

Head of AI
Wireless CSP, USA

Furthermore, while not classified as a "Clear Win" or "Big Bet" in our analysis, CSP in-depth discussions also highlighted their interest in the concept of a "customer service employee coach." These executives recognize the potential of generative AI-powered employee coaches, which can leverage data from customer interactions to offer coaching and performance enhancement guidance to customer service representatives.

> "I see generative AI also for customer service and sales AI coach. We have also experimented with AI tools through a private company for **real-time sales coaching**, primarily for commercial use. These tools listen to calls and provide post-call coaching to the representative, including directions for follow-up.

CEO
Wireline CSP, USA

> **We have been on a journey to implement data-driven coaching and providing data-driven work for front-end employees.** We are giving sales representatives access to performance data on a bunch of KPIs, so you know exactly where they need to improve.

Director of AI
Wireless CSP, USA

Many CSPs noted piloting and using generative AI for software code development. For example, a major European CSP described using the technology for writing code, leading to a 30-45% productivity gain in a trial with around 250 developers.[2] Interestingly, we also heard some reservations regarding tools' security and ability to handle complex code. For example, some CSPs indicated concerns about using existing offerings, given the need to keep code in-house and secure. Additionally, some perceive generative AI to be more suitable for less complex code but not as well-suited for more complex, unique, telecommunications-specific code.

> Our software development team [has] developed our own generative AI coding function to **keep our coding in-house and prevent it from being released externally.**

Strategy Director
Wireless CSP, USA

> In terms of coding, there is a debate. I believe that a significant portion of code, perhaps 80 percent, is common, and only 20 percent is unique. The common code, such as expanding a database by a column, adding a field, or moving it, has already been written. **We need human developers for the unique code that is specific to us.** Generative AI is not awesome but also not horrible at creating code.

Former SVP Technology Architecture
Wireless CSP, APAC

We also examined how the perception of use cases differs among CSPs based on their data capabilities. Among the top 30% of CSPs with advanced data capabilities (based on evaluation of 8 distinct capabilities covered in the next section), there is a shift in focus from only productivity tools to product and marketing use cases that directly impact revenue generation and competitive advantage. Unlike their peers, these CSPs see product and marketing use cases like search term generation and insight generation as Clear Wins that enable a competitive advantage.

Exhibit 9: Clear Win and Big Bet Use Cases for Leading & Lagging Data Capable CSPs

	Leading Data Capabilities High Data Readiness, Top 30%	**Lagging Data Capabilities** Low Data Readiness, Bottom 70%
Clear Win Use Cases (High business value and less difficult implementation)	1. **Product & Marketing**: Search term generation 2. **Customer Service**: Customer chatbot 3. **Product & Marketing**: Insight generation 4. **Customer Service**: Guided employee assistance for knowledge management and troubleshooting	1. **Customer Service**: Contact center documentation 2. **Customer Service**: Customer chatbot 3. **Network Operations**: Guided employee assistance for installation, troubleshooting, and maintenance 4. **IT Operations**: Employee self-service desk
Big Bet Use Cases (High business value and more difficult implementation)	1. **Product & Marketing**: Personalization 2. **Network Operations**: Guided employee assistance for installation, troubleshooting, and maintenance 3. **Network Planning**: Generative route/network design and network configuration 4. **Network Planning**: Synthetic data generation for security testing	1. **Network Planning**: Synthetic data generation for security testing 2. **Product & Marketing**: Personalization 3. **IT Software Development**: Automated code generation, debugging, and testing 4. **Network Planning**: Generative route/network design and network configuration

Product & Marketing | Network Planning | Network Operations | Customer Service | IT Operations | IT Software Development

Our conversations with larger CSPs also noted interest in product-related use cases. Recently, a European CSP announced using generative AI to create new offerings in the sports market, expanding their capabilities and understanding of how generative AI can be monetized (within the media environment).[8] Another example is a CSP from the Asia-Pacific region, which has developed a consumer-focused application that enables users to interact with its digital services such as music streaming, payments, and actions like sending texts and managing schedules.[9] This is in line with our survey findings, where APAC CSPs noted product and marketing use cases such as personalization and new future ideation as high-value opportunities.

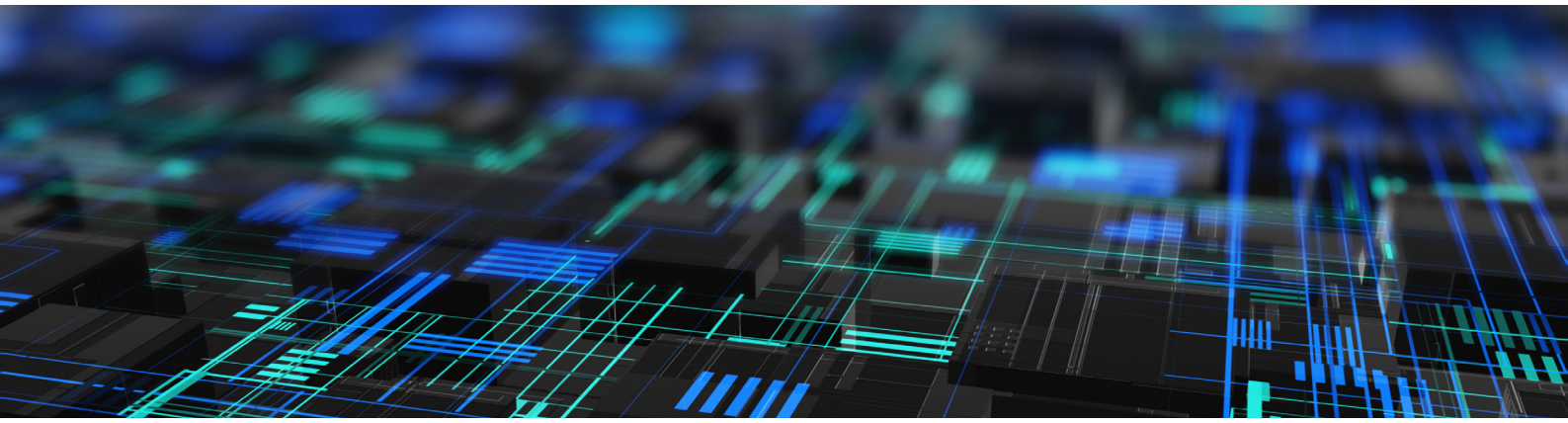
> **"The goal is to transition from being a pure infrastructure player to offering applications and service, and generative AI can be key to unlocking those product offerings.**
>
> Head of Data Science
> Wireless CSP, APAC

Meanwhile, European CSPs notably view customer service use cases as primary focus areas and Clear Wins. One large European CSP explained that cost pressure, while universal in the telecommunications industry, is particularly palatable in Europe. Thus, the focus is acutely on lowering service costs, making generative AI use cases for customer service even more attractive.

Generative AI is an emerging technology with significant potential across a multitude of use cases in the telecom industry. Certain use cases are poised for earlier implementation, promising immediate benefits. In contrast, others remain firmly rooted in the longer-term horizon, requiring comprehensive planning and adaptation to fully realize their potential.

07

Constraints & Complexities



As CSPs delve deeper into deployment of generative AI, realizing these opportunities is not without challenges and complexities. The biggest concern many CSPs share is the current state of data practices and processes within the organization. Specifically, data security, privacy, and governance considerations are noted as top concerns.

Exhibit 10: Top 3 Technical Concerns[1]

% of total respondents responding in the top 3; N = 102

61%

Security, privacy, and data governance concerns of data used by generative AI models

"We are also considering **how to ensure data security** when working with providers, whose servers are based in the U.S. We **need to ensure that our data is secure and not used by other actors.**"

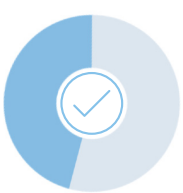
Head of IT Architecture and Infrastructure Strategy, Wireless CSP, Western Europe

51%

Lack of internal technical expertise to implement and manage generative AI

"Many telcos **do not have the in-house expertise to build their own LLM.** Are they willing to take the risk and invest in building a large LLM? This involves cost, manpower, and potentially changing the company's direction."

CTO, Wireless CSP, APAC



46%

Concerns about accuracy & reliability of generative AI output

"Ensuring reliability is key to accelerating the adoption of generative AI. The tool is not fully mature yet, so the quality of the output must be reliable enough for production use **without fear of errors.**"

Head of IT Architecture and Infrastructure Strategy, Wireless CSP, Western Europe

[1]Choose and rank the top 3 technical concerns/challenges related to adoption and scaling of generative AI-related use cases at your organization.

Informed by our discussions with executives, we analyzed data dependency concerning generative AI, focusing on three specific dimensions of data capabilities: the what of data (i.e., data infrastructure), the who of data (i.e., data fluency), and the how of data (i.e., data processes).

Exhibit 11: Communication Service Providers' Data Capabilities

Data Infrastructure

The What of Data:
"I need to invest in things"

- Centralized Data Management
- Data Quality & Integration
- Scalability of Data Infrastructure
- Data Infrastructure Modernization

Data Fluency

The Who of Data:
"I need to hire or train people"

- Data Analytics
- In-House Technical Expertise

Data Processes

The How of Data:
"I need to change my organization"

- Machine Learning (ML) Operations
- Data Governance

Using the evaluation of these distinct data capabilities, most CSPs view their state of data as overall sufficient but lacking specifically in data governance. This remains a top concern even for the top 30% of data capable CSPs.

Exhibit 12: Communication Service Providers' Data Capabilities[1]

Weighted average on scale 1 (less proficient) to 5 (more proficient), N varies by respective domain

HIGH MEDIUM LOW

			Overall	Data Leading CSP's
Data Infrastructure	Centralized Data Management	Degree to which data is collected and stored centrally & easily accessible, avoiding data siloes	3.3	4.5
	Data Quality & Integrity	Data management practices to maintain accurate data & integrate across various systems & vector data bases	3.2	4.4
	Scalability of Data Infrastructure	Degree to which data platform is designed to handle large volumes of structured & unstructured data	3.5	4.3
	Data Infrastructure Modernization	Degree to which organization data resides on virtual private and/or public cloud (includes isolated instances)	3.6	4.8
Data Fluency	Data Analytics	Degree to which the organization uses advanced analytics, AI/ ML to gain insights from data	3.4	4.3
	In-House Technical Expertise	In-house technical talent to maintain data for existing systems & emerging technology solutions	3.3	4.3
Data Processes	Data Governance	Establishment of practices for data documentation, collecting, storing, using and deleting data AND clear defined data ownership responsibilities	2.8	3.7
	ML Ops Practices	Degree to which practices and processes are established for building, deploying, monitoring and maintaining machine learning models	3.3	4.1

[1] For each of the following components of your data environment, please rate your organization's proficiency from 1 to 5; 2) Per market experts, weights are 60% data infrastructure, 15% data fluency, and 25% data processes

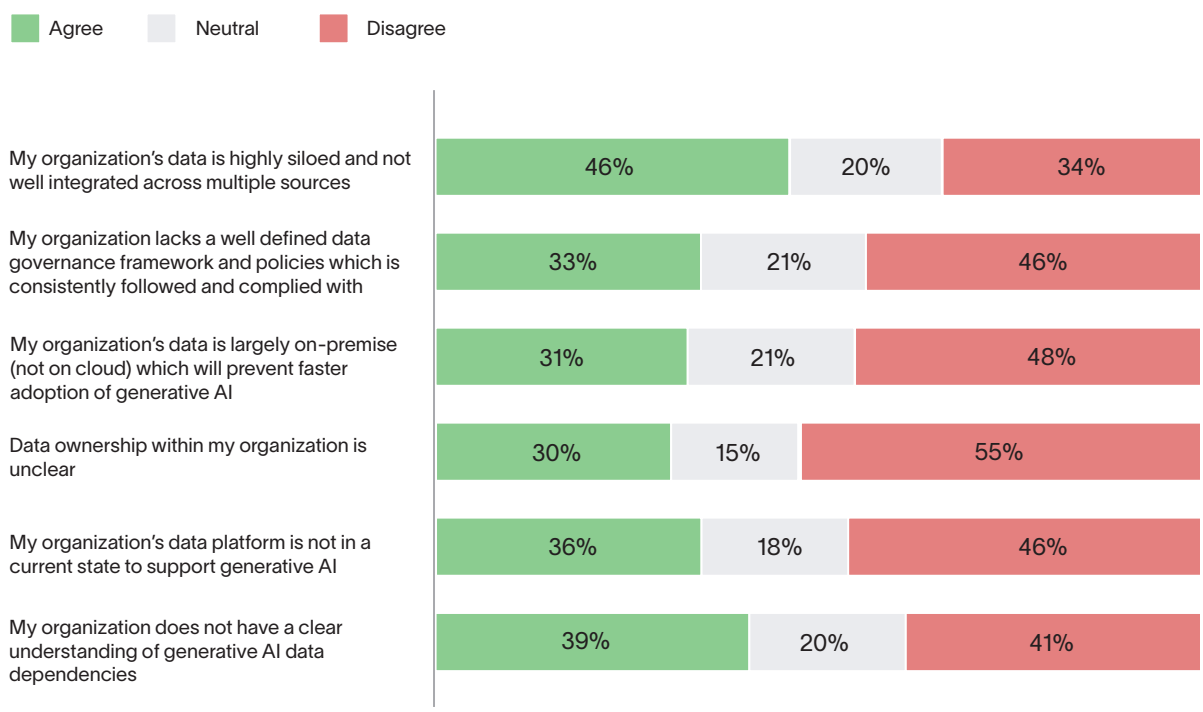
> **A lack of data governance and data ownership procedures are slowing the pace of generative AI adoption at telcos.**
>
> Senior Executive Engineering
> Wireless CSP, USA

> **Data is important from two main standpoints: data availability and data governance,** including processes around who can access that data.

Director of Product Management
Wireless CSP, USA

It is important to note that while CSPs consider data infrastructure to be more "ready" for generative AI and relatively more proficient, they also acknowledge, at times, data siloes are inevitable. Forty-six percent of CSPs agreed their internal data is highly siloed and not well integrated compared to the 34% that disagreed.

Exhibit 13: CSPs' "Readiness" Sentiments[1]
% of responses, N = 102



[1] Please indicate your organization's sentiment on the following statements regarding your organization's data capabilities.

> Integrating **messy data across multiple vector databases** is critical. We need to know **where in the cloud** the data is and where it's **moving.**

SVP Global Systems
Wireline CSP, Western Europe

Given that the current state of data capabilities is top of mind for telecommunications companies, we took a closer look at CSPs that are more data capable and lead in generative AI adoption. As noted earlier, these data capable CSPs exhibit greater emphasis on near-term use cases focused on revenue generation. They also consider these use cases to be, on average, 8% less complex to implement on a data readiness rating scale.

Data-capable CSPs exhibit common organizational characteristics:

- **Dedicated AI Center of Excellence (COE)** – Many CSPs with data-leading capabilities often have a COE for AI and generative AI. Where there are centralized AI/ML departments, these COEs become AI product management functions to the business domains, helping to streamline evaluation and implementation.

- **Pervasive Use of Advanced Analytics** – CSPs with data-leading capabilities often use advanced analytics throughout the organization, not just certain business domains or specialists. These CSPs make it their mission to enable users within the organization to access data on a self-service basis and use it for data-driven decision making. Such companies encourage a data-driven culture, have strong governance practices in place, and foster greater adoption of new AI technologies.

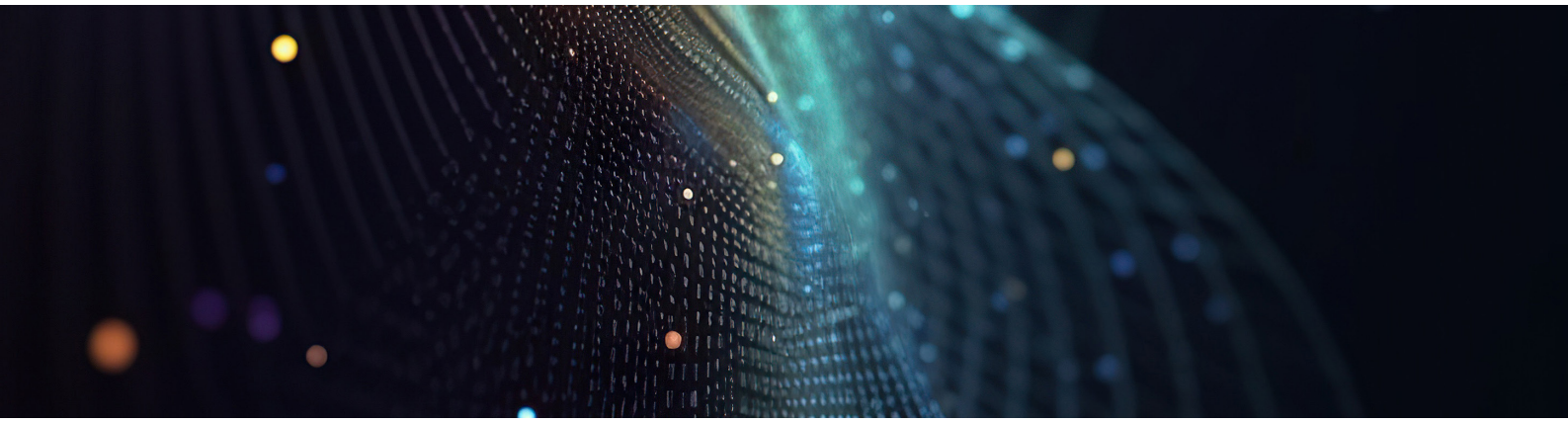
- **Cloud-Based Modern Data Infrastructure** – CSPs with modern, cloud-based data infrastructure are likely to have data architectures that can integrate data from disparate sources. These CSPs are better prepared to meet the security and regulatory requirements for handling sensitive data, and scale to handle the computational requirements to train and deploy generative AI models.

> **"The generative AI will likely accept many different forms of data, as opposed to requiring multiple machine AI engineers. It requires a lot of manipulation to understand different facets as I'm taking data sources from network data, contact centers, and my respective ML learning models. This process is time-consuming. That's why I advocate for more centralization.**
>
> Director of AI and Product Management
> Wireless CSP, USA

Telecom companies' data capabilities and maturity play a pivotal role in shaping their adoption of generative AI. Companies with advanced data capabilities tend to be more proactive in embracing generative AI, leveraging their proficiency to experiment and adopt applications that address both efficiency and revenue generation objectives.

08

Deployment & Implementation



The discussion about improving data capabilities and proficiency is crucial because CSPs expect to primarily use pre-trained, off-the-shelf foundation models, but train these models on CSP-owned, internal data. Across all business domains, more than 65% of CSPs intend to use internal proprietary data for generative AI use cases. This reliance on internal data is consistent with CSPs' objectives of customizing pre-trained models, tailoring them to handle industry-specific terminology and context, and ultimately enhancing output quality. Hence, having a robust data infrastructure and governance is essential to ensure that the foundation model is trained on high-quality and relevant telecommunications data.

> "Many telcos **do not have the in-house expertise to build their own LLM,** so they might opt for a pre-trained model. The challenge lies in the expertise and the company's vision. Are they willing to take the risk and invest in building a large LLM? This **involves cost, manpower, and potentially changing the company's direction.**

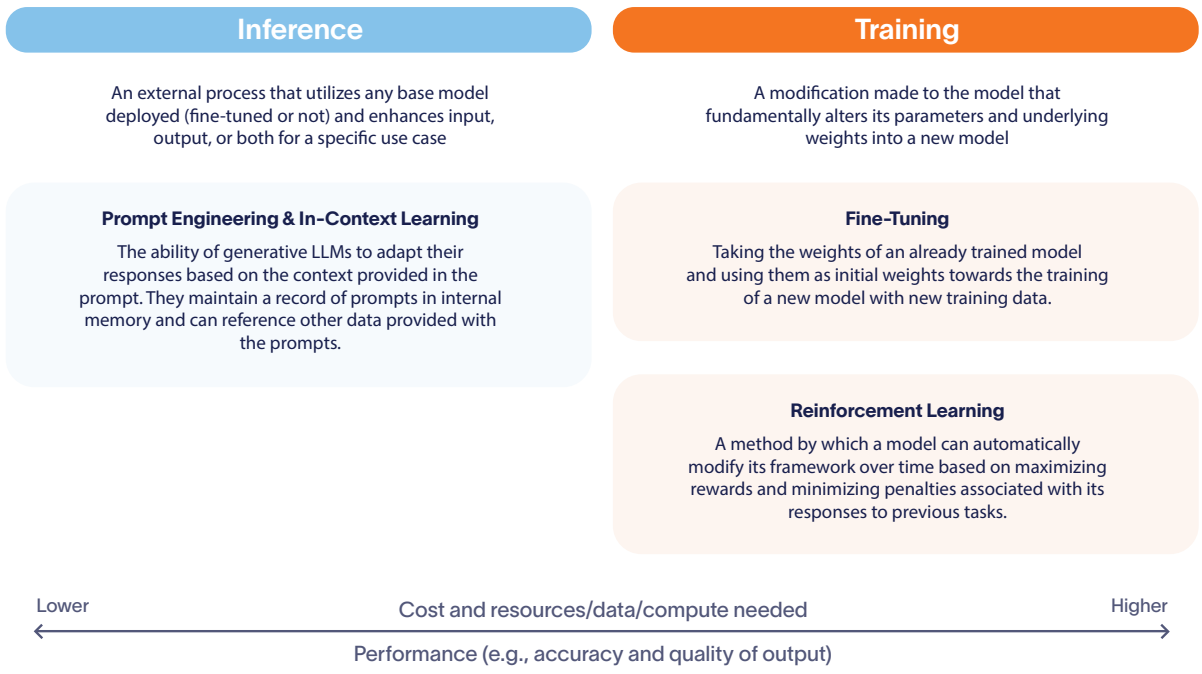
CTO
Wireless CSP, APAC

> "**Every model will eventually need to be fine-tuned in some way.** I don't believe generative AI models should be plug-and-play. To take the models to the next step, we should look at the architecture as fit. If the data is not understood and missing confidence, then it will be inaccurate.

EVP
Wireless CSP, USA

CSPs are broadly considering two relatively different approaches for adapting large language models (LLMs) for specific tasks: fine-tuning or prompt and context learning. These techniques vary based on whether the organization will be customizing the **training** of the foundation model versus **inference**. Fine-tuning trains the foundation LLM by adjusting its parameters and feeding the model additional data. On the other hand, prompt engineering and context learning is used to customize the" inference," i.e., the output of the generative AI model to make it relevant to the domain context while keeping the foundation model parameters frozen.

Exhibit 14: Fine Tuning vs. Context Learning & Prompt Engineering Comparison



Fine-tuning can improve model performance on specific tasks by adjusting a sub-set of model parameters and training the model on a curated task-specific dataset. In contrast, prompt engineering and context learning involve providing the model with a small number of task-specific examples as input. The model then uses these examples to quickly adapt to the task at hand and enhance input, output, or even both in specific cases. This approach can be more resource efficient than fine-tuning, as it requires less training data and computational resources with an output noted as "good enough."

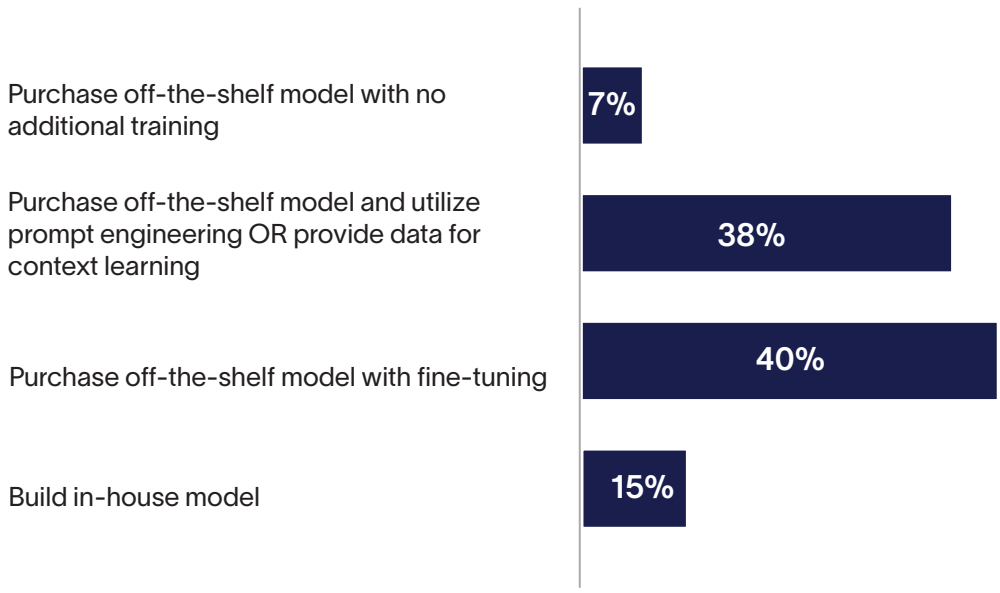
CSPs are concerned about the costs required when implementing generative AI. In fact, 31% of CSPs note concerns around significant operating costs to maintain the model and infrastructure (i.e., opex). Since in-context learning is the cheaper technique as it does not involve any form of training, it is attractive to CSPs given its low resource intensity, only referencing other data provided with prompts for a sufficient-enough output.

But the jury is still out on trade-offs between prompt engineering/context learning and fine-tuning, and their suitability for the various use cases. Both are being explored: 38% of CSPs preferred using prompt and context learning and 40% for fine-tuning to train off-the-shelf pre-trained LLMs. In fact, one CSP executive noted investing in both fine-tuning and prompt/context learning, with the former showing only slightly better results for some use cases. They also stated that fine-tuning required more time, expensive talent, and higher compute resource costs since they were fine-tuning a multi-billion parameter model. In contrast, prompt and context learning was less costly and allowed them to experiment with various open-source models.

> **Right now we're indexing our data in a real-time manner and improving prompts and pre-prompts. We're vectoring data for fast results, but we intend to look more into fine-tuning once GPT3 & 4 allow fine-tuning.**

VP Data & AI
Wireline CSP, USA

Exhibit 15: Communication Service Providers' Preferred Generative AI Implementation Method[1]
% of responses, N varies by respective domain



[1] Please indicate the likely implementation method for generative AI models for the business domain(s) seslected.

> **We invested in both fine-tuning and prompt engineering and found similar results for a number of use cases. There were few use cases where fine-tuning was slightly better. However, the fine-tuning team required more time, more expensive talent, and significantly more money on GPUs. As a result, we shifted our focus to prompt engineering.**

Director of Technology
Wireless CSP, USA

It is also worthwhile to note that there are additional techniques for customizing pre-trained LLMs, such as Retrieval-Augmented Generation (RAG) and reinforcement learning through human feedback. RAG works at the inference level, improving output of the LLM by allowing access to additional data sources (including organization's own data) and retrieve up-to-date information without modifying the underlying model. Reinforcement learning, on the other hand, is a method by which a model can automatically modify its framework dynamically over time based on maximizing "rewards" with its responses to previous asks. However, reinforcement learning can also be expensive if it utilizes feedback from humans (e.g., ranking answers). The associated cost can be a function of how many answers are provided and how thorough the human feedback process is.

While a notable 15% of CSPs indicated interest in building foundation models in-house, this number seems somewhat inflated. Upon closer examination and further discussions with CSPs, an emerging trend becomes apparent: the in-house development of small custom models tailored to telecom-specific needs. These smaller models utilize the LLMs as a framework and are then customized for a specific purpose. For instance, one CSP remarked crafting a custom language model with fewer than 15,000 parameters—a significant contrast to the billion-parameter scale of open-source GPT models. They integrated this model with the LLM to ensure that the CSPs' distinctive voice and communication guidelines were reflected in the results. Similarly, a major CSP is developing an in-house model with over 200 million parameters, which will be used to fine-tune and integrate with third-party LLMs. By using these smaller models to tailor LLMs, telecom providers can improve their performance in specific tasks and improve capabilities such as multilingualism and interpretability. This aligns with our survey results, where some CSPs mentioned developing their in-house models, but often on a more modest scale. Forty-three percent of CSPs also indicated a need to integrate both a large and a smaller language model into their systems.

> "I'm seeing a lot more **teacher-student models** where a larger, more complex model (the teacher) is used to train a smaller, simplified model (the student). The student model is usually more efficient/less expensive.

Head of Strategy and Analytics
Wireless CSP, APAC

> "Our solution takes GPT and **adds a smaller customized LLM on top of GPT** to ensure it has our telco 'voice' and/or communication guidelines come through in the output versus general English.

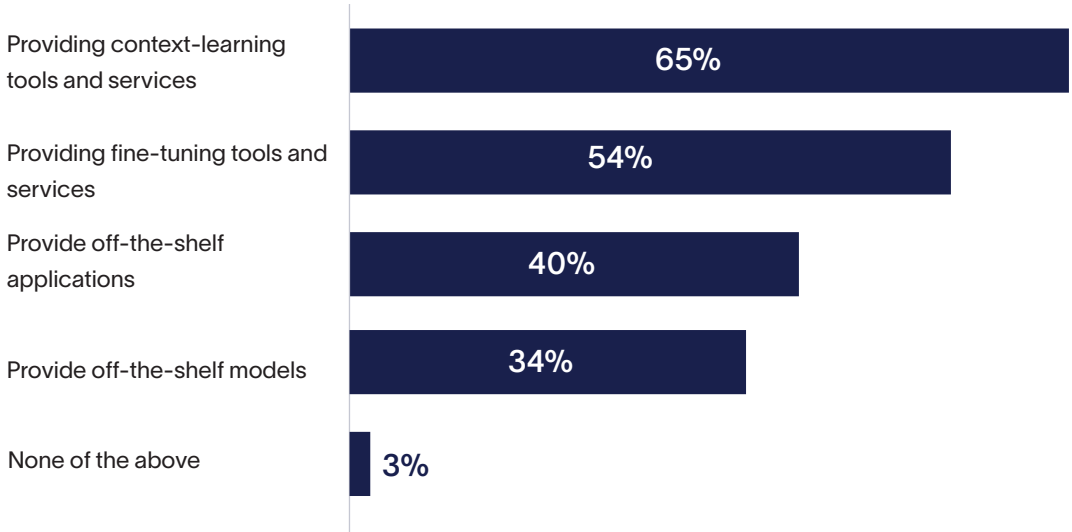
Strategy Director
Cable CSP, USA

> "We took the initiative to build our own large language models (LLMs) for specific use cases and domains because there was nothing available in our country and we wanted to be first movers in that space. From an efficiency and latency perspective, we believe there are **smaller models that we can train and use for certain applications.**

Senior Director of Technology and Business Development
Wireless CSP, APAC

Supporting telecommunication endeavors to customize LLM, multiple enabling platforms and capabilities are emerging to help CSPs explore models & approaches to leveraging their internal data for foundation models. For instance, 65% of CSPs noted context-learning tools and services as the most important generative AI product offering to CSPs, with a high 54% citing fine-tuning tools and services as the most important.

Exhibit 16: Generative AI Product Offerings Most Important to CSPs[1]
% of total respondents ranking in the top 3, N = 102



[1] What product offerings are most important to you when selecting a generative AI solution or provider?

An emerging, notable development is the rise of generative AI-managed service platforms and Model-as-a-Service (MaaS) providers. Managed service providers, for instance, can offer licenses to multiple pre-trained models, enabling companies to access cutting-edge generative AI models via the cloud. This allows organizations to generate innovative content without starting from scratch, akin to a subscription-based software model.

Generative AI fully managed service platforms enable enterprises to integrate multiple models across various premises without being locked into a single provider. Forty-four percent of CSPs plan to use fully managed service platforms like Hugging Face or Lang Chain for their generative AI models. These emerging business models (i.e., Managed Services Platforms and MaaS) offer end-to-end service solutions without the infrastructure and cost demands of a fully custom, in-house build.

> **I strongly advocate for using third-party vendors who are experts in this domain.** Many agile leaders share this view. Some leaders at other companies believe they can build it themselves, but we [CSPs] are not in the business of making models – **generative AI and foundation models are not our core business.**

SVP of Customer Service
Wireline CSP, USA

> The real issue [for CSPs] is the lack of [technical] resources. **Many partners and large language model providers understand that telecommunications companies may not have the necessary resources. And vendors provide their own studio and professional services and help with fine-tuning or help CSPs to fine-tune themselves.** I personally believe that this will be the key accelerator for generative AI in telcos.

General Manager of Advanced Analytics
Wireless CSP, APAC

While much attention is understandably devoted to the complexity of model customization and deployment, it is essential to consider the application layer. Interestingly, 69% of CSPs prefer purchasing off-the-shelf end-user application interfaces for their generative AI solutions rather than building them. This trend spans business domain use cases, particularly focusing on product & marketing and customer service. The rationale behind this preference lies in the convenience of ready-to-use applications, which accelerates time to market and minimizes maintenance.

> For example, in the case of conversational AI, specifically chatbots, **the customer interface is vendor-based.** Every time a customer interacts with the chatbot on our website or app, it launches a code base. We then integrate all the conversational AI components.

Technology & Innovation Director
Wireless CSP, USA

09

Implications & Outlooks

Generative AI adoption within the telecommunications industry is only beginning and will continue to evolve dynamically. This study underscores:

- "Clear Win" use cases, such as customer chatbots and employee assistance, are ripe for implementation. Many of these use cases require a lighter implementation touch and can use an off-the-shelf model with some adjustments.

- More transformative high-value use cases, or "Big Bets," such as network planning and optimization, are of interest but dependent on high-quality and sensitive internal data. Establishing strong data governance practices becomes imperative for CSPs seeking to prepare for potential use cases, especially those related to these "Big Bets."

- CSPs should explore various implementation and deployment options and be aware that the future of generative AI in the telecommunications space will be shaped by technology developments, such as managed service platforms and tools enabling easy customization and development of LLMs (e.g., Amazon Bedrock[10] enabling enterprise developers to evaluate and fine-tune foundation models of choice using custom data or build generative AI apps from scratch), and AI regulations.

Telecommunication companies are confronted with a multitude of technical and operational challenges when harnessing the potential of generative AI. A pivotal aspect of this journey involves a review of data governance practices to ensure the data infrastructure supports compliance to data security, privacy, and sovereignty requirements. CSPs also need to formulate effective strategies for managing data scattered across multiple systems for seamless access to high-quality data.

The significance of high-quality data cannot be overstated, especially when it comes to training generative AI models for telecom-specific tasks and contexts. The reliability of these models, as well as the transparency and trust they inspire through their outputs, hinges on the quality of the data they are trained on.

While many CSPs prefer off-the-shelf models to expedite their generative AI initiatives, the off-the-shelf approach comes with its own set of considerations. Telecom companies are acutely aware of the importance of model customization to suit their unique requirements. This necessitates external vendor platforms that not only provide access to pre-trained models, but also support various methods for model fine-tuning, model training, and model development.

Moreover, the choice of generative AI deployment heavily weighs the security and privacy concerns of data used by generative AI models. As discussed in the previous section, 61% of CSPs noted security as the top technical concerns when considering generative AI.

However, there are increasingly more 3rd party solutions to ease these concerns for CSPs who are considering implementing generative AI. These external vendor platforms are seen as critical accelerators in the telecommunications industry's AI journey. They not only bridge the expertise gap but also empower telecom companies to leverage the advantages of generative AI without compromising on the customization and control they seek. AWS, for instance, is democratizing access to this technology and providing flexible approaches to meet enterprises where they need - whether that be providing infrastructure to build their own foundational models, leveraging pre-trained foundational models to build their applications, or fine-tuning available models with additional data.

Amazon Bedrock allows CSPs the flexibility to work with publicly available models or build their own foundation models based on custom silicon (Inferentia and Tranium chips), in addition to instances built using leading chip providers, to offer price performance infrastructure. With platforms such as Amazon Bedrock, CSPs can strike a delicate balance between expediency and precision, ensuring they stay at the forefront of innovation in their highly competitive landscape.

Regardless, the fact remains that generative AI is already making waves in the telecommunications industry with multiple use cases being tested and implemented in the near future. For communication service providers who are looking to better understand the relative risk and technical complexity when adopting certain generative AI use cases, here are tactical questions to consider:

Exhibit 17: Key Questions to Understand Relative Risk and Technical Complexity of Generative AI Use Cases

Question	Options	Relative Risk	Relative Tech Complexity
What type of use case is under considerations?	Common General Purpose (Knowledge search, guided assistance)	Lower	Lower
	Highly domain specific & niche	Higher	Higher
Who does the use case target?	Customers (external-facing)	Higher	Neutral
	Employees (internal-facing)	Lower	Neutral
What foundational model will be used?	Customize & adjust off-the-shelf, pre-trained models	Higher	Lower
	Build in-house	Lower	Higher
What methodology will be relevant to make the off-the-shelf model fit?	Prompt/context learning	Neutral	Lower
	Fine-tuning	Lower	Higher
What data will be used to train/build the foundational model?	Internal proprietary, own data	Higher	Higher
	Externally available data or synthetic data	Lower	Lower
Where is the internal data stored that will be used to train/build the model?	In databases, which are available and accessible by the team	Lower	Lower
	In multiple siloed databases, which are not well integrated	Neutral	Higher
What type of internal data will be used?	Sensitive data such as customer interactions, network data	Higher	Higher
	Documentation, knowledge databases	Lower	Lower
Are data governance, policies, and ownership, which can impact the use case, clearly defined?	Lack clarity on data governance or data governance policies not rigorously followed	Higher	Higher
	Data governance clear and well-defined	Lower	Lower

The fusion of generative AI and telecommunication isn't just innovative; it's imperative. Having clear answers to use case types, deployment preferences, and data dependencies, communication service providers can ready themselves for the transformative journey generative AI can enable. To thrive in this dynamic landscape, companies must embrace weaving generative AI into the fabric of their operations, and this study can arm them with the insights needed to navigate concerns.

10 Appendix

Glossary

Artificial Intelligence (AI)
Artificial intelligence (AI) is the simulation of human intelligence in machines that are programmed to think and learn.

Context Learning
A process of using internal data to provide prompts to a pre-trained model to enable it to understand the problem or task at hand and provide telecom-relevant responses; requires a medium amount of data to be trained.

Data Lake/Warehouse
A centralized repository allowing the storage and management of vast amounts of structured and unstructured data.

Fine-Tuning
A process of updating and/or adding parameters to a pre-trained model using a new dataset, which results in the model to learn and adapt to nuances; requires a large amount of labeled data to be trained, though smaller than the data set the model was initially trained on.

Generative AI
Artificial intelligence technology that can create original content (e.g., text, image, audio, video) based on a prompt. Generative AI differs from non-generative AI because it can create new content rather than for example, follow a predefined set of rules or make a prediction or classification..

Generative AI Application
User experience platform in which the user interacts with the generative AI tool to produce output from the underlying model.

Generative AI Foundation Models
Artificial intelligence models trained on large datasets that allow AI models to learn the underlying patterns and structures of data and generate new content that is both realistic and contextual.

Inference
The operational phase of generative AI model where it applies the knowledge gained during training to generate outputs that are usable, contextually relevant, and aligned to patterns used.

Large Language Models (LLMs)
A class of foundation models built using deep learning techniques and trained on massive amounts of data to understand, generate, and manipulate human language.

Latency
The amount of time it takes for a packet of data to travel from its source to its destination, often measured in milliseconds (ms).

Machine Learning (ML)
Machine learning (ML) is a subfield of AI that involves using algorithms and statistical models to enable systems to improve their performance with experience without being explicitly programmed. A form of non-generative AI.

Model-As-A-Service (MaaS)
Cloud-based end-to-end solutions providing companies with a way to deploy and maintain machine learning and generative AI models in a production environment.

Parameters
Weights and connections of a generative AI model that determine the model's behavior, capabilities, and ability to generate new data or content.

Prompt Engineering
A process of manually feeding the model prompts to guide model output; requires a small amount of data to be trained.

Rule-Based AI
AI that follows a set of pre-defined rules to make decisions or perform specific tasks; form of non-generative AI.

Structured Data
Tabular data (e.g., tables, databases, or spreadsheets) that can be used to train some machine learning models effectively.

Training
The process in which model parameters are learned during which the model adjusts its parameters to minimize the difference between its predictions and the actual target data/output.

Unstructured Data
Data that lacks a consistent format or structure (e.g., text, images, and audio files) and typically require more advanced techniques to extract insights and analytics.

Definitions

Business Domains

1. **Marketing:** Responsible for creating awareness of a company's products or services and generating leads.
2. **Customer Service:** Responsible for providing support to customers before, during, and after they make a purchase.
3. **Network Planning:** Responsible for designing and implementing the network infrastructure.
4. **Network Operations:** Responsible for managing & maintaining the day-to-day operations of the network infrastructure.
5. **IT Operations:** Responsible for managing the organization's IT infrastructure, including servers, storage, and networks.
6. **IT Software Development:** Responsible for developing and maintaining the organization's software applications.

Use Cases

1. **Marketing**
   - **Content Generation (Text, Image, Video):** Creating valuable, relevant, and consistent marketing content for various channels (e.g., ads, email, social media, web pages, etc.); includes copy generation and web page content generation.
   - **Search Term Generation:** Generating the most optimal relevant keywords and phrases for search engine optimization (SEO).
   - **Personalization:** Generating tailored marketing messages and content based on customer information (e.g., demographic, history, behavior).

   Product
   - **Insight Generation:** Generating new customer insights to inform product enhancements and service improvements based on customer information.
   - **New Feature Ideation:** Generating the most optimal relevant keywords and phrases for search engine optimization (SEO).

2. **Customer Service**
   - **Customer Chatbot:** Interpreting and responding to customer queries and requests in a human-like conversational manner.
   - **Employee Coach:** Uses data on customer interactions to provide coaching and performance improvement guidance to customer service representatives.
   - **Guided Employee Assistance for Knowledge Management and Troubleshooting:** Retrieve and respond to employee queries using knowledge base of articles, FAQs, customer case history and other documentation for issue resolution.

- **Contact Center Documentation:** Generate transcription of calls, summarize customer interactions and suggest follow-up actions.

3. **Network Planning**
    - **Generative Route/Network Design and Network Configuration:** Generate a variety of possible network designs optimized for key parameters (e.g., topography, costs, power, etc.).
    - **Network Image Generation:** Generate designs such as CAD of physical aspects of a network project scheme including but not limited to maps, blueprints, etc.
    - **Synthetic Data Generation for Security Testing:** Artificial data that mimics real-world data, which is then used in testing security systems and identify vulnerabilities without needing to use real customer information.

4. **Network Operations**
    - **Guided Employee Assistance for Installation, Troubleshooting, and Maintenance:** Retrieve and respond to network service engineers with information to aid in installation, troubleshooting, and maintenance network devices and infrastructure like routers, switches, and firewalls.

5. **IT Operations**
    - **Guided Employee Assistance for Installation, Troubleshooting, and Maintenance:** Generate responses or summarized information when employees install, troubleshoot, and maintain software and hardware systems within an organization, specifically those encompassing end-user devices and applications like computers, tablets, and CRM software.
    - **Employee Self-Service Desk:** Generative chatbot where internal employees can self-service IT issues

6. **IT Software Development**
    - **Automated Code Generation, Debugging, Testing:** The use of automated tools to create code, find and fix errors in code, and test code.
    - **Automated Code Documentation:** The use of automated tools to generate documentation for code that is similar to existing documentation often using natural language processing or non-generative AI.

Process Terminology

- **Evaluation:** The process by which an organization assesses a use case for technical performance and capabilities to decide whether to implement or not
- **Implementation:** The process by which an organization deploys and integrates the use case into the day-to-day operations of the company
- **Adoption:** The process of the evaluation and implementation of a use case at an organization; in this study, we define current adoption as if the organization has fully implemented/implementing the generative AI solution while interest is if the organization has implemented OR has a high likelihood of implementing the solution

Data Capabilities

- **Centralized Data Management:** Degree to which data is collected and stored in a centralized manner, avoiding data siloes to ensure data is easily accessible and usage across the organization (e.g., data lake, data warehouse, etc.)
- **Data Quality and Integration:** Degree to which organization has implemented tools and practices for master data management to maintain accurate data as well as integration capabilities to enable data flow between various systems and multiple vector bases.
- **Scalability of Data Infrastructure:** Degree to which data platform is designed to handle large volumes of structured and unstructured data.
- **Data Analytics:** Degree to which the organization uses advanced analytics, AI/ ML to gain insights from data, improve business operations and drive decision making.
- **Data Infrastructure Modernization:** Degree to which organization data resides on virtual private and/or public cloud (includes isolated instances, etc.)
- **Data Governance:** Establishment of practices for data documentation, collecting, storing, using and deleting data AND clearly defined data ownership responsibilities.
- **MLOps Practices:** Degree to which practices and processes are established for building, deploying, monitoring and maintaining machine learning models.
- **In-House Technical Expertise:** In-house talent and technical expertise to maintain data infrastructure and architecture for existing systems and emerging technology solutions (e.g., data scientists, scrum masters, etc.)

Adoption Methods

- **Off-The-Shelf:** Model that is pre-trained on a large dataset and available for purchase or free use.
- **Prompt Engineering:** A process of manually feeding the model prompts to guide model output; requires a small amount of data to be trained.
- **Context Learning:** A process of using internal data to provide prompts to pre-trained model to enable it to understand the problem or task at hand and provide telecom relevant responses; requires a medium amount of data to be trained.
- **Fine-Tuning:** A process of updating and/or adding parameters to a pre-trained model using a new dataset; requires a large amount of data to be trained.
- **Build In-house:** Model that is developed and trained on a custom dataset and is owned and operated internally.

Data Sources

- **First Party Data:** Data the company collects directly from customers, website visitors, or social media followers.
- **Third Party Data:** Data the company obtains from external sources or organizations that are often specialized in collecting and aggregating data from diverse sources.

Use Case Contexts

- **External Use Case:** Interactions between an internal system and 3rd party external factors such as customers & stakeholders outside the business.
- **Internal Use Case:** Interactions between a system and its internal actors like a business's own processes, employees, and data.

End Notes

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About Altman Solon

Altman Solon is the largest global strategy consulting firm exclusively working in the Telecommunications, Media, and Technology industries. With thirteen offices across the Americas, Europe, and Asia Pacific, our team of consultants possess a diverse range of expertise in strategy, commercial, operational, technical, and capital markets. We work with market leaders, challenger brands, and investors worldwide to help them identify, develop, and implement effective company strategies, new market entry approaches, digital transformation, and global M&A. We also provide comprehensive market understanding to conduct due diligence and enable high-stakes, confident decision making for investors.

Altman Solon combines this new Survey with proprietary insights from its recent study, Putting Generative AI to Work, from Spring 2023, which analyzed emerging enterprise use cases by examining generative AI companies and capabilities. Our team surveyed 292 senior business leaders and spoke to 21 industry experts to understand the adoption of generative AI tools for specific high-impact enterprise use cases. The surveyed decision-makers' roles covered a range of strategic and technical functions, and the findings highlight adoption and adoption reasons for generative AI. All survey respondents were from the United States of varying business sizes. Altman Solon focused on four areas with strong momentum: software development, marketing, customer service, and product design, and found the highest adoption in software development and marketing and emerging adoption in customer service and product design.

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