

Generative AI implications for telco operations

White paper

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Introduction

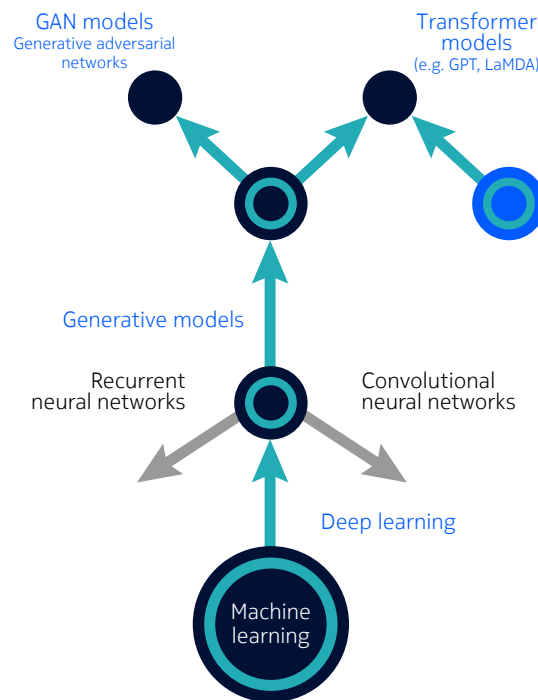
Open AI's launch of ChatGPT in late 2022 took the world by storm and propelled AI into public consciousness. Shortly after, generative AI became a buzz word prompting many to invest and capitalize on its potential benefits.

But what is generative AI?

Generative AI is a branch of machine learning (ML) that creates new content (e.g., text, images, and audio) from training data. Generative AI models are based on generative adversarial networks (GANs), variational autoencoders (VAEs), and transformers, with the latter being used in large language models (LLMs). Examples of LLMs that use transformers are Gemini, Bard, and LaMDA from Google and GPT and DALL-E from Open AI.

Transformer-based models can be trained on massive amounts of unstructured data to perform numerous tasks such as classification, summarization, prediction, translation, and content generation.

Figure 1. Machine learning map with Generative AI



While generative AI fuels creativity and collaboration, it comes with its own challenges that need to be addressed. These challenges include training bias, hallucinations and other ethical issues resulting in the model's potential collapse and risk of disinformation (e.g., deep fakes). Text-based models face additional challenges such as factuality, malicious prompts (i.e., prompts intended to expose proprietary or controversial content), intellectual property risks and privacy concerns.

What’s in it for telcos?

Telecom service providers (also known as telcos or CSPs) sit on large volume of data waiting to be utilized. Telcos have been using AI to optimize and improve their customer, business and network operations. Most AI models are focused on predictive analytics (e.g., churn prediction, traffic forecast, purchase behavior) including classification (customer segmentation, site analysis, anomaly detection).

Generative AI will significantly augment telco business and technology operations enabling them to deliver superior services and experiences more efficiently.

The potential use of generative AI for telco operations is very broad, but can be grouped as follows:

- Faster access to information without having to source it from multiple places.
- Synthesis of such complex information to provide meaningful insights
- Contextualized communication and guided action based on those insights.

The table below shows different AI models and the various applications areas in telcos.

Table 1. Generative AI models and the respective application areas in telcos.

Model	Applications in telco
LLMs (e.g., GPT)	• Human augmentation: call center script automation and conversation, customer support, interactive self-support (chat over billing, tech support, etc.) • Sales strategies: based on certain customers and their data usage. • Value-added services: near real-time translation of SMS, notification of overages, events, etc. • Source code writing.
GANs and VAEs	• Synthesis of training data (e.g., hot spots, coverage maps, busy hour traffic patterns) • Detection of interference and coordination of spectrum sharing • Anomaly detection • Digital twins of subsystems, systems, and processes
Others (e.g., Bayesian models, autoregressive models)	• Predictive root cause analysis • Forecasting traffic, subscriber growth and churn

Generative AI for telco functions

The use of generative AI as mentioned previously can be contextualized into various uses cases based on specific telco functions. Bell Labs Consulting has studied and classified several use cases and the role they are likely to play in shaping the future of CSP organizations and functions.

Table 2. Select use cases impacting different functions in a telco organization

Communication service provider or (CSP) or telco organization		
Marketing and sales - Marketing and sales material, leads - Fraud detection	Customer care - Care agents' augmentation - Care agents' replacement	Finance, legal and supply chain Simplification of mundane tasks requiring text generation
NW engineering, testing and deployment Design: Creative solutions for capacity planning, congestion detection, resilience design NW planning and optimization: Synthesis of coverage maps, generate text inputs to digital twins,... Testing: Automated generation of test case descriptions, automated execution of tests	Operations - Operational personnel augmentation in NOCs or field services to better react to incidents - Augmentation of operational personnel with automatically generated next best actions especially for complex contexts	IT - Code development acceleration (e.g. integrations, API creation, low/no code system etc;) - Code migration from legacy to modern platforms - Ease of interaction with cloud resources - Hiding complexity of business processes

Bell Labs Consulting has also analysed the impact of generative AI on the use cases and resulting benefits in the following areas of a telco organization:

- Customer care operations
- Network design
- Network performance and optimization
- Testing.

Customer care operations

Introduction

Customer care operations are at the forefront of customer engagement and are the primary interface for consumers and enterprise customers. Customer Care plays a leading role in delivering both digital and on-call customer experience and is one of the biggest benefactors from the adoption of AI use cases.

Top challenges in customer care operations

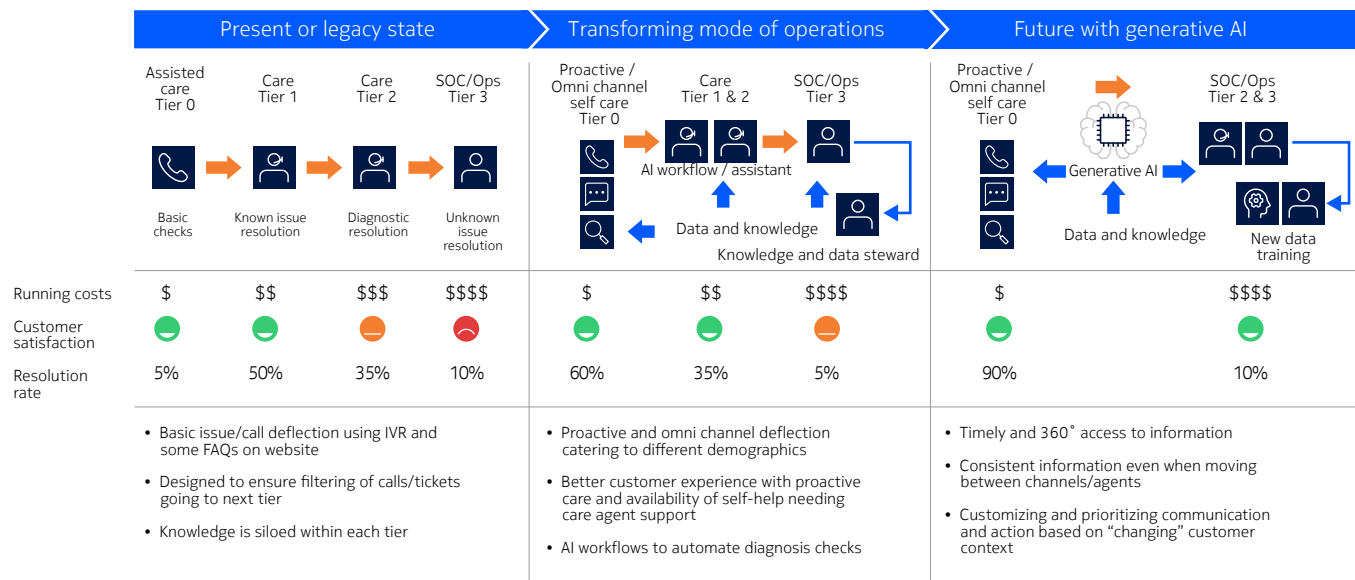
- Demand increase for customer experience excellence at lowest possible customer care OpEx (operating expenses)
- Time and effort for retrieving and processing information needed for customer complaints response
- Information loss while moving across tiers, channels and teams
- Lack of customization of end-user communications and experience based on profile and context.

Customer care operations with generative AI

Customer care operations have been undergoing a gradual digital transformation over the last few years, by leveraging data, knowledge and digital self-service capabilities for its customers and agents. Many operators are slowly moving away from a tiered model of customer operations delivery, through a 'left shift' approach of ensuring early resolution of customer complaints as reflected in Figure 2. This has required opening omni-channel customer support tailored to different demographic needs, while retaining traditional on-call support.

Generative AI can enhance and speed up this transformation to the future state in Figure 2. Telcos who are currently in the process of such 'left shift' transformations will see acceleration and faster realization of business benefits.

Figure 2. Transformation of customer care operations



In Table 3, a non-exhaustive list of use cases with generative AI is listed. Their successful adoption will further result in a trickle-down effect on other use cases across various operations functions in telcos.

Table 3. Generative AI use cases and benefits for customer care operations

Use case	Generative AI impact	Use case brief description	Benefits
Enhanced self-care	Care agent replacement	Enhanced access to self-help/ service capabilities using generative AI via omni channels allowing more issues to be solved via self-care.	• Reduction of calls and tickets needing agent support • Improved customer experience
Timely and enhanced information for care agents	Care agent augmentation	Using generative AI, get faster access to information including 360° view of customer, troubleshooting data and synthesis for faster resolution of customer complaints.	• Agent effort reduction • Faster ticket resolution • Improved customer experience.
Customized communication	Care agent augmentation	Using generative AI customizing communication for each customer by care agent-based on customer profile, history, current issues, demographics to ensure best services irrespective of channel.	• Enhanced customer experience • Reduction of tickets

Benefits for customer care operations

Generative AI can accelerate transformation of customer care operations, putting telcos in pole position to deliver top-notch customer and employee experience through reduction of service requests and optimization of costs. The quantitative impact points to significant benefits for telcos in leveraging generative AI for customer care operations.

Figure 3. Benefits of generative AI for customer care operations



Network and service design

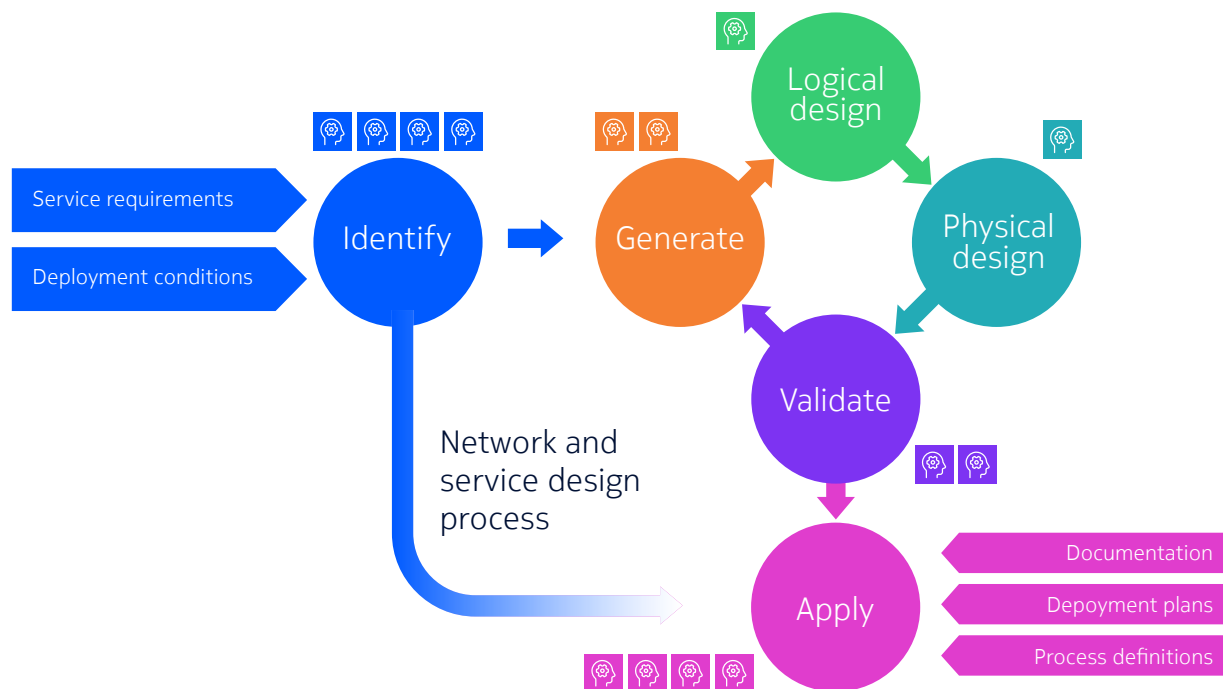
Introduction

Network and service design is one of the most pivotal steps in enabling a sound and effective service. It determines the service quality, security and reliability as well as the total cost of ownership (TCO). Finding the best design is a complex task and requires knowledge, experience and a lot of effort. Like many tasks, the question arises if and how generative AI tools could ease some of the burden of the design process.

Network and service design challenges

Engineering design processes are often thought of as a recurrent create-validate cycle evolving into an optimal solution:

Figure 4. Network and service design process



- An identification stage specifies the problem to resolve, the requirements and conditions, involving longer term usage profiles and market developments that are hard to predict
- Generation of ideas and brainstorming produces potential solutions and variations from the requirements and conditions. Among many options, it may be difficult to select promising candidates
- Logical and physical design (in any order or mixed) is cumbersome and will often rely on simulation tools to optimize performance, reliability, power consumption and TCO
- Validation rates the result against an abundance of complex criteria and decides whether a new cycle is needed to process a new option
- Application of the design involves the laborious extraction from multiple sources of low-level design documentation, deployment plans and process descriptions to ensure efficient and reliable operation.

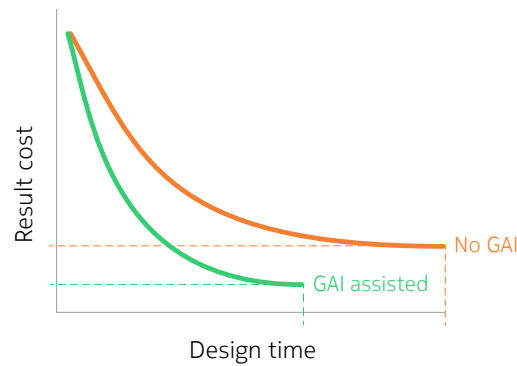
Opportunities for generative AI

The design process and its challenges point to several opportunities where generative AI could help or take over tasks:

- Assist in research for obtaining accurate usage and deployment data and assist in forecasting
- Insight into trends could help the design of more robust and flexible network designs, lasting for longer periods
- Create solutions and scenarios natively and produce innovative options that human architects may not think of.
- Assist in multi-goal design optimization and validation (GANs are currently being investigated for network design optimization)
- Produce comprehensive, accurate documentation and translation into low-level-designs, deployment plans, process definitions and training material.

Given that doing multiple iterations, creating and adjusting scenarios, and varying design options can make for a lengthy process, generative AI can improve the quality of the result and reduce the time spent on the design process (refer to graph below):

Figure 5. Design result cost function over time, with and without generative AI (GAI)



Benefits and challenges of generative AI in network design

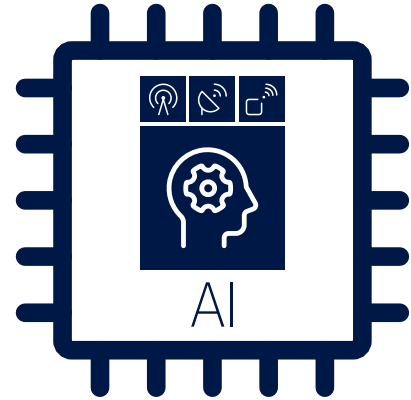
Generative AI provides several potential benefits to network and service design processes, especially in the creative and generative steps.

- Design times can be kept shorter
- Designs can become cheaper to produce
- Designs can be more accurate, complete and optimal
- Designs can consider additional, unforeseen options.

There are however challenges and investments to consider when adopting generative AI:

- Generative AI applications may introduce hallucination effects and bias issues that require careful human supervision to ensure quality and avoid senseless design cycles and suboptimal designs
- Effective deployment of generative AI requires expert prompt engineering and other AI skills from involved personnel.

Figure 6. Benefits of generative AI in network design



Network performance and optimization

Introduction

In the face of increased growth in subscribers and traffic demand, network performance and optimization (NPO) processes:

- Reduce expenditures of radio access networks (RAN)
- Make networks future-ready for the next technology evolution
- Maximize spectral efficiency.

Network performance and optimization at present

At present, NPO focuses on enhancing services currently offered by cellular providers. It improves radio coverage, capacity, and quality. Improving each of these objectives requires a set of processes that are carried out by a workforce of well-trained telecommunications engineers. Measuring the improvement of these objectives is often done by the network performance processes owners, who define a group of key performance indicators (KPIs).

Network performance and optimization with generative AI

While telcos tout the robustness of their NPO processes, they also admit that there is room for greater efficiency and innovation. Figure 7, below, lists four use cases where NPO can benefit from Generative AI.

Figure 7. Examples of generative AI in network performance and optimization

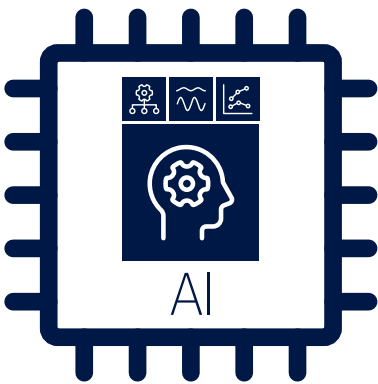
Generative AI in network planning and optimization			
Synthesis of network coverage maps, hot spots and traffic patterns		Automated interference detection and decentralized spectrum sharing	
		Detection of network performance faults and anomalies	
		Digital twins of RAN and NPO processes	

Benefits and challenges of generative AI in NPO

Despite the benefits of generative AI for NPO, Bell Labs Consulting analysis has shown benefits across economic, customer and employee value dimensions (Figure 8).

Figure 8. Benefits of generative AI in network performance and optimization

	Impact on costs • Reduced operational expenditure per task • Enables better reallocation of risk mitigation costs
	Impact on customer experience • Faster resolution time • Reduced involvement of resolution stakeholders
	Impact on employee experience • Improved use of employee's time on the job • Reduced probability of errors



While generative AI comes with numerous benefits, it also poses challenges to its adoptability in the NPO space. These challenges can be broadly classified as follows:

- Challenges to current ways of working, for example, measuring resource utilization on an NPO project
- Challenges to future ways of working, in this case, the risks of generative AI such as hallucinations and malicious prompts, especially in the LLM space, require NPO engineers to regularly fact-check the output of these LLMs for relevance, misuse, and truthfulness.

Testing

Introduction

Any project for new software (SW) solution implementation requires an entire cycle of functional and non-functional testing to prove that the introduced product satisfies all business, operational and safety requirements and that the new SW is integrated correctly with the relevant parts of the existing enterprise infrastructure. Depending on the maturity of their existing testing process, telcos can already see short-term benefits from generative AI, with larger returns likely in the future.

Testing at present

Test creation typically consist of two major functions:

- The SME (subject matter expert) or QA (quality assurance) team (depending on the project and the organization) creates test descriptions based on the business requirements or scope of work (SOW), product descriptions, design documents, etc. In simple cases, pre-defined test lists and description templates may already exist, with QA customizing and populating values for specific project parameters in the template. In more complicated situations, the test document may need to be extensively customized or even written from scratch.
- A team of developers create a set of automated test cases based on the test descriptions.

Challenges of the current testing process

- If the project contains multiple software component integrations, overall test plan creation can take considerable time
- In the absence of a simulation-driven approach, risk from corner test cases may be underestimated, while creation of simulation tools can be lengthy and expensive.
- In complex integration projects, the communication overhead created by large number of SMEs, QA and facilitators involved can generate substantial project cost.

Testing with generative AI

Generative AI can be introduced in progressive steps in validation procedure development.

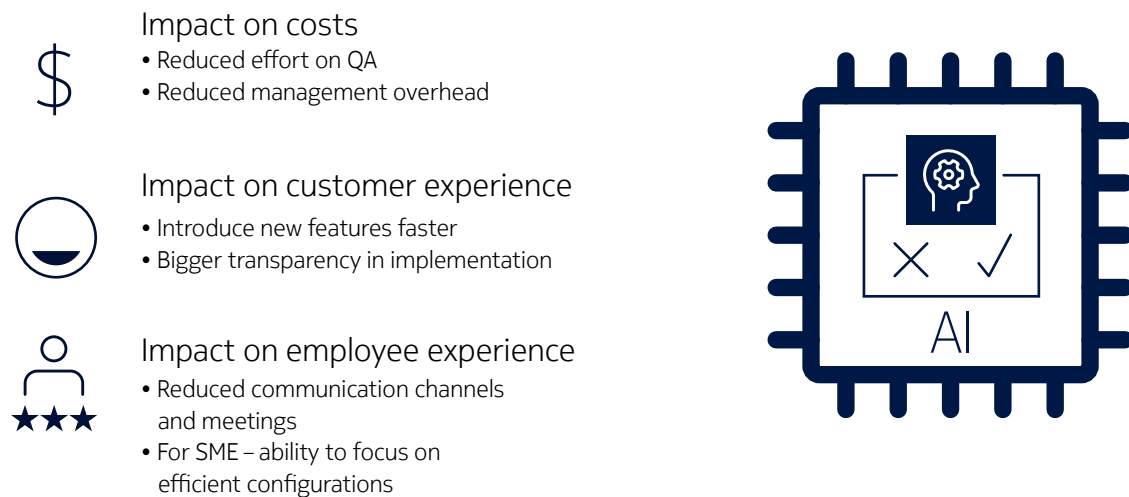
1. It is already possible to speed up automation test code development by using co-pilots built on various generative AI models. Also, QA can populate project design data in the existing test description template using models or scripts, while SMEs can do the final check of the result
2. A more challenging but interesting use case involves writing test program descriptions from scratch with generative AI using product and design documentation, while SMEs create iterative prompts and check the output. This will require generative AI tools that are able to recognize and understand diagrams and charts in the source technical documents, so that they can be used together with the text of those documents for describing call and message flows and node connections. This case is not readily available and may require extensive development from telcos or vendors to fine-tune currently available models to the task and domain specifics.

3. A combination of the above use cases, where an SME, powered by an automation suite co-pilot, will be able to quickly transform some test descriptions to the automated test scripts and evaluate test scenarios for risk level or other parameters before adding them to the continuous integration/continuous delivery (CI/CD) process. This will greatly reduce testing time by eliminating low-risk scenarios and increasing test coverage of the risky corner test cases. CSPs will need to establish robust tools and process for this augmented design process, or else risk loading SMEs further, and adding even more costs.

Benefits for using generative AI for testing

Bell Labs Consulting experts used a representative set of between 30 and 50 test cases to observe the benefits of generating and coding tests with and without the support of generative AI. Our observations from this exercise confirmed significant positive impact from using generative AI (as reported in Figure 10).

Figure 9. Benefits of generative AI for testing



Challenges of generative AI for testing

The major risk of deploying generative AI tools is that the benefits for CSP will heavily depend on solution implementation details. The new process architecture will need to guarantee reduction of workload for SME's and QA, and furthermore presence of correct, curated and verified source documentation as an input for every stage of the process. This will mitigate additional costs due to effort spent by the engineering team to fix test descriptions as compared to writing it themselves.

While risks of deploying generative AI for the test program development use cases need to be considered and mitigated, initial steps can already be taken with the current level of maturity of generative models, leading to more sophisticated use cases and commensurate benefits.

Business benefits

Methodology

To calculate the business benefits of generative AI on various functions, Bell Labs Consulting studied different use cases in each of the functions and the related efficiency was quantified based on various effort baselines. This was further aggregated at each function level based on weighting each use case within the overall function.

Customer care operations: Calls and tickets were considered at various stages of the customer care operations and the related use cases ranging from proactive and/or self-care to agent support and augmentation to arrive at productivity benefits.

Network design: We considered different use cases at different stages, such as identification, generation of ideas, logical and physical design, validation, and application, and the relative reduction of effort was estimated to arrive at the productivity.

Network performance and optimization: Various use cases from different activities in an NPO process were considered, including coverage maps, interference detection and performance faults, and we considered the relative effort needed to arrive at the productivity increase.

Testing: The productivity increase was calculated by considering the relative effort of combining test case description development and automation test cases code development for a batch of 30 to 50 test cases with or without Generative AI.

Benefit analysis summary

Based on the methodology described above, we generated a range of productivity benefits for each of the functions considering the weighting of the use case per function.

Customer care operations is likely to benefit the most from the introduction of generative AI in its operations. The transformation of proactive and self-care omni-channel support already underway in the industry will be further accelerated. Agent augmentation with generative AI will drive significantly faster customer response and enable customized, targeted and contextual communications. Generative AI introduction is expected to further increase productivity in customer care operations in the range of 25% to 40%.

Network design is likely to see a productivity increase in the range of 14% to 22% with the introduction of generative AI to assist research and obtain relevant forecasting data, bring new insights in next designs and design documentations, including low-level designs, plans, definitions and process material.

Network performance and optimization by introducing generative AI to synthesize coverage maps, hotspots and traffic patterns as well as interference and performance fault detection can bring a productivity increase in the range of 17% to 24%.

Testing will see a productivity increase in the range of 13% to 25% by introducing generative AI in test code development, writing the test program description document, and creating automated test scripts.

Figure 10: Range of productivity increase expected in functions

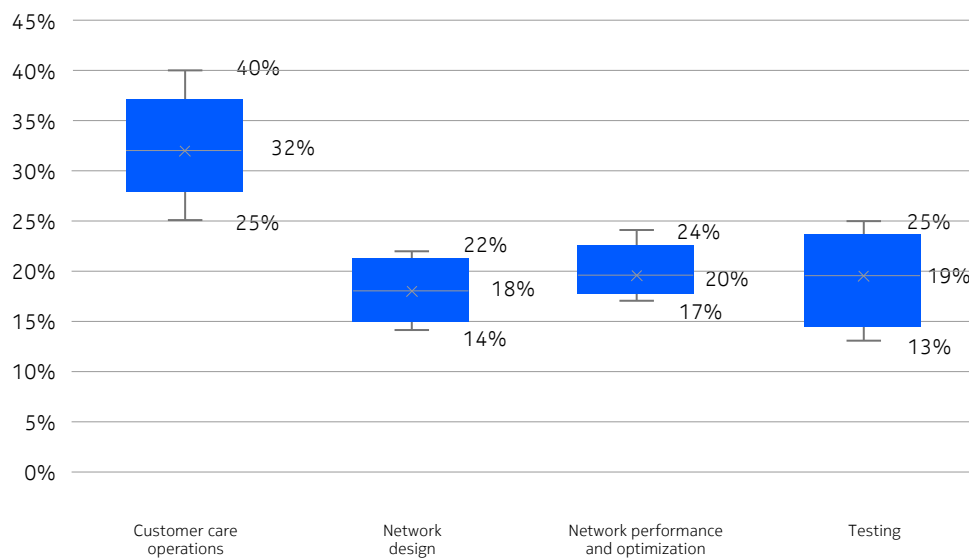


Figure 10 above shows the summary benefits of the key use cases. It excludes already existing transformations happening in each of the functions and only considers what additional benefit generative AI can bring on top of existing transformations.

The costs of building or leasing generative AI capability is not considered in this section but is explained below when considering the range of options.

Key decisions

Building a generative AI model from scratch comes with its own set of challenges for any organization, including telcos. Most of the existing foundational models in the market have been built by companies known both for their product innovation and leadership and their size and market coverage. The amount of data collection, storage and processing power required mandates upfront investment and commitment. Telcos have been looking for the silver bullet(s) when it comes to the application of AI to increase their digital services portfolio. However, investments towards this objective are hampered by declining operating margins and while generative AI holds much promise, it is still evolving. This conundrum brings telcos to two critical questions:

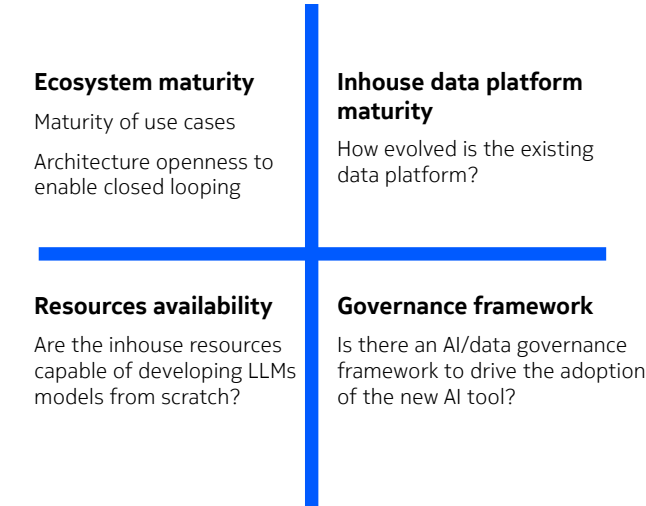
- Should telcos wait for generative AI use cases to mature further to be assured of results, or should they act now as a trend-setters in the hope of early mover advantages and rewards?
- Should they build their generative AI capability in-house or buy?

Wait or act?

The answer to the question of whether telcos should wait or act, requires an unbiased assessment of the current operating model and the culture of the telco organization. Since operational readiness is imperative to unlock value, the assessment framework should cover a few important areas at a minimum:

1. **Maturity of data platform:** Understand how evolved the current data platforms are. Models can only learn and provide useful outcomes if they have a quality dataset to learn from.
2. **Ecosystem maturity:** The output of generative AI tools needs to be integrated back to the telco and partner ecosystem to realistically benefit from generative AI tools. Depending on the use cases, telcos may require an open architecture for any future implementation. They need to evaluate their digital maturity to identify domains which are (and soon will be) mature enough.
3. **Availability of skilled resources:** Generative AI use cases may not require extensive in-house data science skills depending on whether the telco chooses to build the models in-house or rely on available models. However, they will require skilled resources to drive the initial wave of adoption and avoid 'hallucinations' impacting business operations. This will require identification and retraining of both data and domain subject matter resources.
4. **AI governance:** Having existing AI/data governance frameworks and enabling cross functional teams can help telcos get a jumpstart on adopting new AI tools. Without such frameworks, telcos face challenges in scaling up early pilot models.

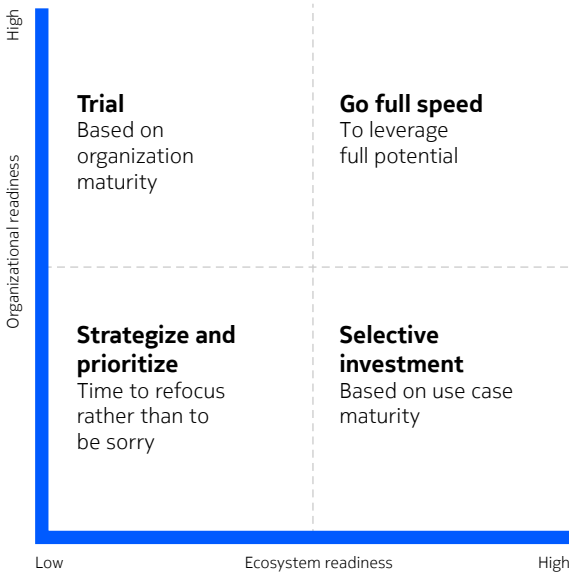
Figure 11. Key dimensions to be considered in assessment.



Build or buy?

The choice between build and buy is not often straightforward. It requires an understanding of the complete value chain of generative AI tools and applications, strategic fit into an organization, and where it wants to focus its investment. Figure 12 below provides a high-level decision-making quadrant.

Figure 12. High-level decision-making quadrant



Most telcos have launched their evolution journey, and the key question to ask is whether they have the required capabilities. There are a few other factors to be considered, as well, like scalability, security, regulations and so on. It may be more beneficial to partner with companies that already have foundational models and fine tune them to telco requirements. Business operations models are likely to be the first to mature and be implemented in the telecom environment. Network use cases will require some level of co-creation between OEMs, telcos and AI partners.

Conclusions

There is a lot of hype around generative AI, but it shows promise. There are many possible use cases for generative AI in the telco domain, but telcos will need to build the necessary capabilities to deploy generative AI use cases in their environment. Before proceeding, they should carefully analyze their future requirements and assess how mature their digital ecosystems are. Are they ready to leverage the potential of generative AI? Further, do they have the necessary guardrails in place to safeguard against undesirable effects of generative AI such as hallucinations?

Generative AI is here to stay and can help telcos accelerate their transformation to more data-driven, AI-based operations. While generative AI shows a lot of promise, it also comes with its own challenges including concerns of training bias and generation of incorrect or fake information. In an environment where network outages and customer mistrust make headline news, a single misstep with generative AI can have devastating consequences. As such it is critical that telcos manage these risks to minimize impact while adopting generative AI into their operations.

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Abbreviations

AI	Artificial intelligence	OpEx	Operating expenses
CI/CD	Continuous integration/continuous delivery	QA	Quality assurance
CSP	Communications service provider	RAN	Radio access network
GAI	Generative AI	SME	Subject matter expert
GAN	General adversarial networks	SOW	Scope of work
KPI	Key performance indicators	SW	Software
LLM	Large language models	TCO	Total cost of ownership
NPO	Network performance and optimization	VAE	Variational autoencoders
OEM	Original equipment manufacturer		

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