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# AI-Driven Analytics for Telecoms

Using AI to enhance  
analytics use cases in  
telecoms



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# Summary

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## Catalyst

At the heart of communications service providers' transformation is analytics to provide insights to support the management and monetization of networks. However, current analytics tools and workflows are not robust enough to support the ongoing changes within the business and the network. Communications service providers (CSPs) must therefore seek ways to improve their use of data analytics to derive benefits in line with business objectives.

## Omdia view

As CSPs evolve their networks and operations, they require systems that can scale to support the increasing complexity within their networks. Artificial intelligence (AI) can help CSPs to manage complex networks and operations more effectively. AI systems use various techniques to imitate human cognitive functions such as learning and reasoning.

There are several AI techniques, including machine learning (ML). ML is a subset of AI that uses algorithms to build mathematical models, "training" itself on large sample data sets without relying on explicit instructions. ML uses these models to provide insights on current events, make predictions, take decisions, or suggest actions based on such insights. While data analytics may be used to perform similar tasks, it relies on explicit rules created by humans. Data analytics cannot refine its models and is less able to handle analysis involving complex relationships between multiple variables.

Other AI techniques besides ML that can be applied within the CSP environment include deep learning (DL) and reinforced deep learning (RDL). While ML is the most popular AI technique, DL is gaining traction because it is not reliant on humans to supervise its learning processes. Consequently, the DL approach to AI can scale AI use cases quicker than traditional ML techniques.

The application of AI spans multiple CSP domains including operations, monetization, and security. AI use cases apply to both legacy networks and next-generation 5G networks. It is a key element in 5G network service delivery, enabling 5G networks to support technologies such as network slicing, edge computing, and network virtualization at scale.

Access to the right data (especially training data), AI skills, and trust in AI solutions are the top challenges that CSPs will have to overcome as they deploy AI within the business. They will need to ensure that they have a robust data infrastructure, which addresses data collection, storage, management, and governance. They will need to invest in the right skills to build and maintain AI models. They will also require greater transparency into the inner workings of AI models to address the "trust" challenge. As CSPs continue to evolve their networks, investment in AI will be crucial, not as a one-off investment but as a lifetime investment for the business.

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## Key messages

- CSPs can use AI to address their top business challenges, including the reduction of operational costs and network complexity, and the management and monetization of 5G services.
- AI's real-time, predictive, and decision-making capabilities can be applied to improving existing network and care operations, identifying and fulfilling new monetization opportunities, and securing the network.
- AI technologies are highly relevant to 5G networks, particularly in supporting new technologies such as network slicing and multi-access edge computing (MEC).
- Implementing AI will come with challenges such as providing access to the right data, bias in AI agents and training data, and lack of skills; such challenges can be tackled through a comprehensive data strategy, investment in training and skills (either in-house or through partners), and fostering a culture of trust in AI through transparency.

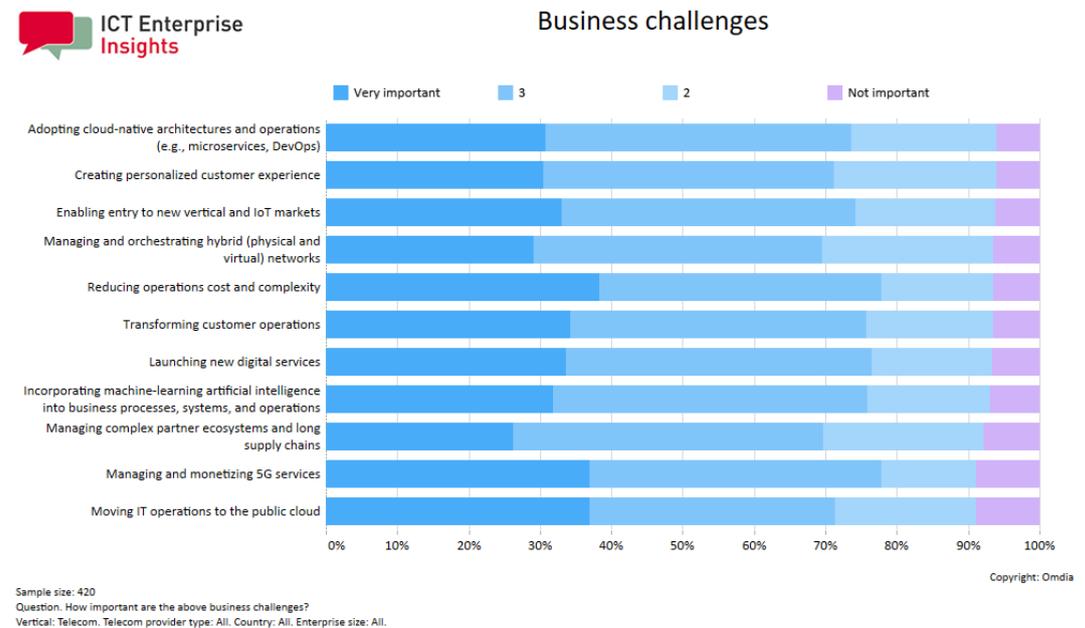
# Using AI to address CSPs' business challenges

## CSPs' top business challenges relate to the growing complexity of their networks

CSPs face multiple business challenges, and according to Omdia's *ICT Enterprise Insights 2019/20* survey of more than 400 senior ICT managers, the top two are to

- reduce operational costs and complexity
- manage and monetize 5G services.

Figure 1: Top business challenges CSPs are facing



Source: Omdia

CSPs are transforming their networks and business processes to improve customer experience, achieve operational efficiency, and grow revenues. They are investing in 5G and Internet of Things (IoT) to drive new revenue growth objectives. They are also deploying technologies such as network functions virtualization (NFV) and software-defined networking (SDN) to address inflexibility and lack of agility in rolling out new

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services and value to customers. Unfortunately, a siloed approach to network transformation has introduced more complexity, making operations less efficient. As a result, operational costs continue to increase, and the quality of customer experience is hampered. In addition, the massive increase in online data generated in the digital world has made cyberattacks increasingly difficult to detect. Threats remain undetected for longer, while new data privacy regulations impose ever more substantial fines for data breaches. Cybersecurity has become a board-level concern for CSPs' enterprise customers and both an opportunity and a challenge for CSPs.

To address these challenges, CSPs need capabilities that help provide more visibility and control over their networks and the activities occurring within the networks. They need to be proactive and responsive to customer needs and events occurring within the network.

Analytics enables CSPs to improve visibility into the network by analyzing the massive volumes of logs, event data, user behavior, traffic data, and security information in their complex network environments. The insights that CSPs derive from that data are used to inform next best actions. The goal of the widespread use of data analytics has been to deliver more efficient and secure operations, improved revenues, profitability, and a better customer experience.

## The role of AI in addressing these business challenges

Network traffic is set for further dramatic increases with the rollout of new digital technologies and services. Omdia's Network Traffic Forecasts indicate that traffic in 2023 will be four times the volume recorded in 2018. This increase in network traffic will result in massive volumes of data being generated by the network. Consequently, the standard rules-based approach to performing analytics will not be enough to support the level of activity needed to control and manage the network. Additional variables and metrics will be needed to detect and identify events of interest, analyze them, and deliver appropriate responses. Humans do not have the capacity to define or modify the rules required to perform these tasks unaided. They cannot achieve the speed and accuracy required for CSPs to meet their business objectives.

AI provides CSPs with the capabilities to manage the increasing scale of network events to be analyzed. AI can be used to detect and respond to common recurring events and low-level incidents without requiring human intervention. AI systems use various techniques to replicate human learning and reasoning capabilities in machines. They learn from large sample data sets (training data) and, based on these learnings, build a model that defines relationships between variables of interest. AI systems then apply these models to predict future outcomes and prescribe actions to be taken, refining the model as they ingest increasing amounts of live data.

There are different AI technologies such as ML, DL, and RDL. The most common of these technologies is ML. ML is gaining traction within telecoms because of its application in automating network management tasks for CSPs. Omdia's report *Using AI to improve CSP Network Operations: Use Cases* indicates that the top AI use cases for CSPs relate to network operations and management.

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There is, however, a downside to using traditional approaches to ML. The most common form of ML is based on a class of learning known as “supervised learning.” Supervised learning is where the training data consists of inputs paired with desired output data. During training, the algorithm searches for patterns in the data that correlate with the desired outputs; it learns how the input and output variables are mapped together. Once trained, a supervised learning algorithm should have an accurate enough mapping function that it can take in new unseen inputs and predict the output based on prior training data. It is called supervised learning because the algorithm is learning from a training data set, which is, in effect, the “teacher.” While basic ML models do become progressively better at whatever their function is, a major disadvantage is that training requires large, inclusive, and unbiased data sets. Learning is based on labeling data, a process that takes time and is highly manual and susceptible to bias.

#### Deep learning to enhance the challenges of traditional ML

There is, however, a class of ML techniques, known as deep learning, that addresses some of the challenges associated with basic ML methods. DL is an architecture that combines multiple neural networks and multiple types of training algorithms into layers that are trained in turn and provide the input for deeper layers. Each layer transforms the input data into more abstract representations before it is passed to the next layer. The output layer then combines these representations to make predictions such as that an image is that of a cat or a specific person whose likeness is known to the system. Unlike ML, DL does not rely on labeled data to perform its learning. Consequently, this approach can be applied to unknown data sets to deduce patterns associated with these data sets. Learnings can then be applied to predict future scenarios and deduce root causes of detected events.

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# Use cases for AI-based analytics in CSP networks

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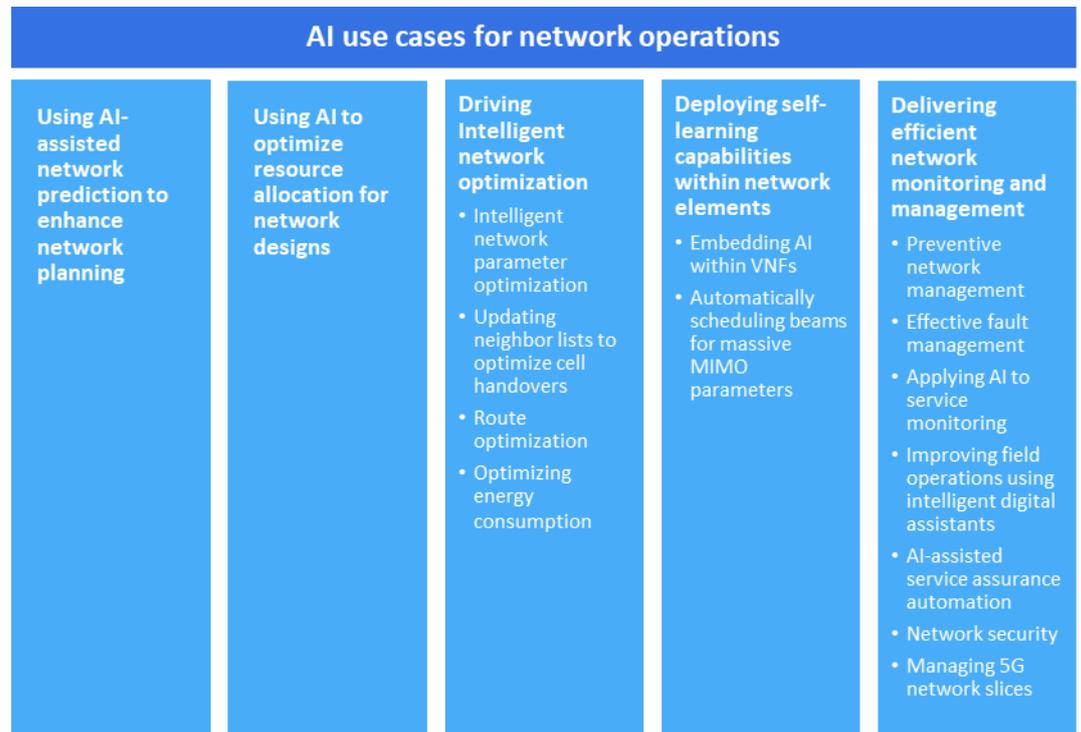
CSP networks will need to become more flexible, adaptive, and intelligent if they are to address the business challenges identified in Omdia's *ICT Enterprise Insights 2019/20* survey. Operators need to become agile and more proactive with respect to monetizing their network and service offerings and managing the operations of their network. By applying AI techniques to CSPs' customer and network data, CSPs can generate real-time visibility into customer service usage and network performance, for example. They can utilize these insights to proactively address issues related to operations, monetization, and security.

## Operations

### *Network operations*

Network operations is a popular use case for AI as CSPs explore its use to support their network automation objectives. ML models are being developed to forecast traffic for the purpose of network planning, intelligent network optimization, and preventive network maintenance. For example, SK Telecom's T Advanced Next generation OSS (TANGO) utilizes ML capabilities to detect network issues, identify the root cause, and optimize network performance. Figure 2 provides a summary of the typical use cases where AI can be used to address network operations challenges.

Figure 2: AI use cases for network operations



Source: Omdia, Using AI to Improve CSP Network Operations: Use Cases

The virtualization and cloudification of networks will accelerate the automation of CSP networks. However, this automation will benefit from AI in addressing the complexity of evolving hybrid networks. CSPs such as KDDI are already deploying AI to operate their telco cloud environments.

*Customer care operations*

Operators must become more efficient and improve on their speed in responding to customer inquiries, and this is another popular use case for AI-based solutions. For example, AI systems can categorize customer inquiries based on the complexity associated with resolving the inquiry. Inquiries that need a simple and routine response can be addressed either automatically or by pointing the customer to a self-service digital channel. More complex inquiries can be routed to an agent. AI can also be applied to reduce the time spent by care agents in responding to customer queries. AI can speed up keyword and natural language searches, automatically checking for previous inquiries of a similar nature and providing suggestions for potential solutions.

AI can also be used to preempt customer calls at the care center. For example, AI models can be trained to identify and predict potential network issues and identify services and customers that would be impacted by this network fault. Based on these insights, CSPs can prioritize the faults they need to address and take necessary remedial action to deliver optimal experiences to customers. Actions might include sending messages to customers to let them know a network issue is imminent and is being resolved or automatically resolving these issues where possible. By improving customer experience in this way, CSPs can reduce customer support costs and the time spent identifying root causes for network issues.

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Swisscom and T-Mobile US are examples of operators that have embraced these solutions in enhancing their customer care operations.

### Monetization

There are several monetization use cases – both internal and external – for AI-based solutions. Insights relating to customers' consumption patterns, for example, can be used to target and rank offers to customers based on their propensity to buy or their usage patterns. AI can also be applied to customer loyalty programs to drive revenue opportunities and reduce customer churn. Operators can map loyalty rewards to specific customer interests by analyzing service usage patterns.

AI solutions are also applicable to external monetization use cases. Insights from CSP data assets or the combination of data from CSPs and third parties can be used to enrich services delivered by third-party organizations. These services are delivered within the confines of regulatory policies. A good example is the broad range of enterprise services, including location-based marketing and digital advertising, provided by Telefónica's data unit, Luca.

### Security

Network security threats are increasing exponentially with the growing number of connected devices on CSP networks, increasing network virtualization, and the increasing sophistication and growing number of threat actors and cybercriminals targeting global and regional networks. As well as needing to improve customer experience and secure network assets, CSPs must adopt a more preventive approach to addressing cyberattacks. Through the application of AI's fast learning, predictive, and decision-making capabilities to the analysis of traffic and other relevant data assets, security threats such as distributed denial-of-service (DDoS) attacks and trojan horses can be detected more quickly and the risks mitigated before they have time to cause damage. BT, for example, uses AI in its security operations centers (SOCs) to assist its cybersecurity experts. AI is a key element in the evolution of BT's cybersecurity strategy. Network security engineers in the operator's SOCs use AI-enabled visualization of events and indicators of anomalous behavior, for example, to enhance their ability to detect and respond to attacks.

### Identity assurance

Subscribers' identities are under various threats. CSPs, therefore, need identity assurance solutions to maintain subscribers' trust in a service originator's identity. An identity assurance solution must fulfill the following:

- know the service originator's identity
- determine why the service is being requested (service intent)
- determine whether there are any concerns associated with this request
- identify actions to take to avert any problems.

An identity assurance solution can leverage AI and behavioral analytics based on network data related to past behavior of the service originator, for example, an IoT device establishing a session to upload data or a call being set up on the network to achieve these functions. The insights obtained can then be used to generate a reputation score

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for each service request, identify any concerns, and determine the appropriate actions to take. Based on the reputation score of the service request, the CSP may block the service, route the service to an alternative destination for specialized treatment, or simply provide indication to the terminator about the reputation score of the originator.

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# Impact of AI in supporting CSPs' 5G deployments

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The focus for most operators now is 5G. However, deploying and managing a 5G network will add even more complexity to operating the CSPs' network infrastructure. As well as representing a different networking model (using SDN/NFV), 5G represents one that can deliver more flexibility to CSPs and customers. It will deliver new technologies such as network slicing and edge computing enabling CSPs to seek out new revenue opportunities. However, the coexistence of 5G with legacy networking models will make operating this hybrid network a challenge.

Network traffic will inevitably increase significantly with consumption of 5G-based services. AI will be applied to the large volumes of data generated by this traffic to help CSPs better manage their networks. AI can be applied in the following areas:

- **Network optimization of the 5G network.** Current rollout of 5G networks involves 4G and 5G network coexistence. Assuring 5G services with high throughput and speed requirements will be challenging in such environments. AI applications such as traffic classification can be applied within 5G networks to ensure that 5G traffic is optimized and served effectively.
- **SDN/NFV.** These technologies enable 5G networks to automate network-resource lifecycle management with the ability to dynamically scale resources in line with customer requirements. The result is reduced costs and increased agility of the network environment. However, intelligence from the network will be crucial in orchestrating the virtual environment. Given the complexity of the network, AI will be required to provide this intelligence. For example, the learning and predictive capabilities of ML and DL models can provide service orchestrators with insights on when virtual resources need to be scaled up or down in line with demand from customers.
- **Microservices-based EPC.** While microservices-based architectures promise to make network application development more agile, they make application management more complex. Instead of monitoring a single monolithic application, multiple microservices need to be tracked to assure service or application performance. AI can be applied to monitor microservices running in container-based environments in order to identify and troubleshoot anomalous events on the network.
- **Multi-access edge computing.** The concept of MEC has been developed to enable CSPs to deliver applications such as autonomous vehicles and autonomous factory-floor control systems with low-latency communications, local computation, and data processing requirements. The AI-enabled network use cases that support these autonomous systems include traffic classification at the network edge to detect

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traffic types that demand real-time processing versus those that can be transmitted to the core for processing.

- **Network slicing.** Implementing network slicing demands high levels of operational agility from the network in detecting and predicting traffic types and identifying the network slice best suited to handling the traffic. ML and DL models can be trained to perform these functions and to monitor the performance of network slices to determine when an overload or failure is likely to occur. Remedial actions can be triggered by the AI model to correct any undesirable or anomalous behavior and assure the quality of services.

# Challenges and recommendations

## Data management strategies, availability of skills, and trust will impact CSPs' adoption of AI

CSPs should expect several challenges when implementing AI in their analytics workflows. Table 1 provides a summary of the top challenges with recommendations on how to address these challenges.

**Table 1: Summary of top challenges in implementing AI and recommendations for resolving them**

Challenge	Recommendations
Prioritizing AI use cases: with several AI use cases to implement across the CSP organization, prioritizing use cases will be difficult.	AI implementation strategy should align with business priorities. CSPs should focus on mature use cases that have been proven to deliver value. Use cases should also be prioritized based on access to the data needed to implement them.
Getting access to high-quality data sets: data is critical to implementing AI. Unfortunately, the changing CSP network environment, the siloed approach to operations, and the complexity of running a multivendor environment mean that access to the required data assets will be challenging.	Build a robust data infrastructure. In building this data infrastructure, CSPs should identify what data sets they need and the data sources generating them. They must also determine how to access and manage these data sets. The data infrastructure can be centralized or distributed depending on your organization's structure and priorities. However, the most important objective is to ensure that strong data governance is in place to secure and manage the data effectively.
Availability of skills: most CSPs lack the AI expertise required to develop and implement AI in the network. Telecoms has also not been the most attractive industry for AI talent.	Develop AI skills internally or work with partners. Depending on your budget, you can decide to develop these AI skills in-house or work with partners that have AI expertise and a track record of AI implementations.
Building trust in AI: most AI systems (especially those based on DL) come as black-box solutions offering little visibility into how decisions are made or the key factors driving these decisions. As a result, trust in these systems' ability to manage the network and make explainable decisions will be low.	Ensure transparency in your AI development. It will enable engineers to assess how the AI systems arrive at their decisions and to adjust models if required or when they become outdated. Consequently, all activities involved in the development of AI (either in-house or via vendor partners) must be accompanied by documentation that provides guidance on how decisions are determined by an algorithm. This guidance is necessary to build employee confidence in the AI solutions. It also ensures that potential biases in the system that might raise security or ethical issues are addressed before the system is put into production.

# Appendix

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Ribbon Communications delivers software solutions that enable CSPs to deliver efficient and secure services. Included within its portfolio of offerings is the Ribbon Analytics portfolio, which consists of prepackaged applications for operations, security, and monetization. These applications support activities within network planning, services assurance, security, customer service, and marketing organizations within a CSP's environment. Ribbon Analytics utilizes machine learning, deep learning, and other AI technologies to predict events of interest (for example, network problems) before they occur and deduce root causes. To learn more, visit [ribboncommunications.com](http://ribboncommunications.com).

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