



Digital transformation and the road to 5G





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As communications service providers (CSPs) upgrade their networks with the latest 4G technologies and look ahead to new 5G innovations, they also have to consider how to become agile operators. CSPs have to learn how to launch new digital services more effectively to drive new revenue streams and compete with over-the-top (OTT) players. Failing quickly and launching new services quickly, is the way forward. Underpinning this strategy is digital transformation, where **CSPs** globally are transforming their businesses from the inside out to transition into digital service providers (DSPs).

In this document, we take a look at the innovative 4G and 5G services that are and will be enabled by this transformative process, as CSPs ready their businesses for the future digital economy. The document also highlights a key insight that digital transformation, in addition to enabling 5G services, has immediate benefits to the core of CSP businesses almost independent of 5G.

Information for this document was gathered through a series of direct interviews with tier 1 and tier 2 CSPs, along with Q4 2017 direct survey of over 50 global influencers (including 26 CSPs) on their 5G efforts, and their digital transformation initiative. Publicly reported information has also used.

Digital transformation: Current and future challenges

Digital transformation is easier said than done, especially, because the process of transforming a CSP into a DSP affects every aspect of the business. This includes infrastructure, operations, business models and partnerships, employees, culture, services they deliver, and, most importantly, their new role in the value chain. Digital transformation not only provides the basis for future service offerings based on 4G and 5G networks but also brings challenges for traditional CSPs with the introduction of virtualized IT processes. Networks based on Network Functions Virtualization (NFV), software-defined networking (SDN), cloud-based platforms and “as-a-service” concepts, will force CSPs to find different ways of working and require their employees to have a whole new skillset.

In fact, it would be difficult to find an operator who is not undergoing some sort of significant transformation process. There are also tools in place to help them measure their progress, such as TM Forum’s Digital Maturity Model (DMM) launched in May 2017. The tool is endorsed by BT Group, China Mobile, China Telecom, China Unicom, Orange, PCCW Global, and Vodafone, as well as management consultancies and suppliers. It offers a set of metrics that can be used to measure digital maturity across five dimensions such as customer, strategy, technology, operations, and culture (people and organization).

A report published by McKinsey in October 2016¹ also outlined five steps that operators need to take if they are to win the digital revolution. They include:

- Reinventing the core by introducing digital processes, analytics, and an omnichannel experience for customers
- Moving into adjacent businesses such as financial services, IT services, media, or utilities in search of new opportunities and revenue streams
- Building talent and digital capabilities
- Overhauling the IT infrastructure
- Using the customer experience to inform their entire strategy

An ACG Research paper (published in February 2017) compiled on behalf of Hewlett Packard Enterprise, titled **Digital Transformation Telco Playbook**, also points out that while there is no single definition of a DSP, there are several characteristics that the service provider needs to consider as it plans its transformation. These include an “intense focus” on the customer, a culture of innovation, an ability to thrive within an ecosystem, a nimble infrastructure, and the ability to work with government and standards bodies.



Digital transformation: Enabling 5G

A fundamental aspect of digital transformation relates to the types of new services that this process will enable, with a particular emphasis on services and applications designed to capitalize on the characteristics of future 5G networks.

The industry is still in the early stages of 5G but that has not stopped operators from supporting the development of digital services and applications that will one day benefit from the improved latency and higher speeds of 5G networks. Now that the 3GPP has completed the intermediate standard non-standalone 5G New Radio (NR), operators can move ahead with their plans to test and launch new networks and services. The operators can be safe in the knowledge that vendors and chipmakers will be able to work with common industry guidelines.

At the same time, figuring out the use cases for 5G has not been straightforward and remains a work in progress. That is partly to do with the advancements that have been made with Long-Term Evolution (LTE) and LTE-Advanced technologies. Indeed, vendors and operators have attained download speeds of 1 Gbps and higher in LTE and LTE-Advanced trials with the application of carrier aggregation and multiple-input, multiple-output (MIMO) adaptive antenna technologies.

One question often asked about 5G is—what will it be able to support that is currently not possible with 4G networks? Use cases that have been defined so far have attempted to focus on the potential they provide in terms of revenue growth and cost savings. In addition, there is a growing recognition that operators will also need to provide industry-specific services targeted at vertical sectors such as the automobile industry, utilities, manufacturing, retail, and more while finding new revenue-sharing models. This marks a departure from the more traditional approach of focusing on services targeted at the consumer.

The 3GPP has already defined more than 70 different use cases, now categorized into different groups—massive Internet of Things (IoT), critical communications, enhanced mobile broadband (eMBB), and network operation. In its NGMN 5G White Paper published in February 2015, the Next Generation Mobile Networks (NGMNs) Alliance also claimed that 5G would support “countless emerging use cases with a high variety of applications and variability of their performance attributes.” The alliance developed 25 use cases grouped into eight families such as broadband access in dense areas, broadband access everywhere, higher user mobility, massive **IoT**, extreme real-time communications, lifeline communication, ultra-reliable communications, and broadcast-like services.

The role that 5G is expected to play in business and industry cannot be understated. A June 2016 paper, **NGMN Perspectives on Vertical Industries and Implications for 5G**, placed a “prominent focus” on verticals’ requirements of 5G, “in growing interaction with, engagement of, and input from the verticals industries.” It presented use cases for the automotive industry, transport and logistics, health and wellness, smart cities and utilities, and agriculture.

The 5G Infrastructure Public Private Partnership (5G PPP) was established by the European Commission, industry manufacturers, telecommunications operators, service providers, subject matter experts (SMEs), and researchers. They also produced a white paper in 2015² that outlined the role that 5G will play as “a key enabler for Factories of the Future” in what has been dubbed the “fourth industrial revolution” or Industry 4.0.

² 5G and the Factories of the Future, 5G PPP, October 2015



Digital transformation: Pre-5G and 5G use cases

Looking ahead to the digital consumer, business, and industrial innovations that 5G is expected to facilitate, Vodafone produced a report in March 2017, along with Arthur D. Little called **Creating the Gigabit Society—the role of 5G**. The report explores what could be in store in a new telco digital universe. According to the report, over the next five years “we will see a revolution in the capability and application of high-speed digital mobile services, as telecommunications companies invest in the fifth generation of mobile radio networks.”

Based on conversations with CSPs during our Q4 2017 survey, as well as available information from global CSPs, there’s a clear trend that vertical market CSPs are targeting 5G. Here, we provide a broad range of challenges and opportunities in each of these areas, as well as describe a selected number of operator trials that have already been announced in some of these fields.

Healthcare: The ambition for 5G in healthcare is to enable mobile remote care solutions through a guaranteed and secured connection, to help solve challenges such as aging populations, an increase in people with chronic diseases, and greater expectations for personalized care.

Manufacturing: The goal here is to use 5G to provide a highly resilient, secure, and low latency communication platform in the factory to resolve pressures on costs and combat an aging workforce, among other issues.

Security: 5G could support wireless security applications for monitoring and detection amid the globally increasing threat of cyberattacks and other security alerts.

Agriculture: Here, the increased speeds and capacity in 5G networks could support the use of drones, as well as remotely connect and control farming machinery.

Public transport: We all want more efficient public transport systems, and 5G could help support better operational performance and maintenance of infrastructure, while also supporting information and entertainment services along the way.

Energy and utilities: 5G has a potentially huge role in improving how we supply and consume energy as pressure on consumption grows, enabling the provision of smart grids that can be monitored and controlled remotely.

Smart cities and buildings: Related to smart grids but going beyond, CSPs are working with cities and building owners worldwide to enable more intelligent information services (smart elevators, superior heating, ventilation, and air conditioning [HVAC] controls, intelligent traffic routing, air quality management, and more) to better utilize resources and improve the quality of life of residents and tenants.

Automotive: Autonomous driving and connected cars have provided one of the highest profile examples to date of cross-industry collaboration in 5G. Networks could be dynamically configured to address the different demands of this highly promising sector.

Media and entertainment: In this area, 5G is expected to enable networks and resources to be dynamically configured to address different demands. It is expected to resolve demands for better quality of service and enable providers to deal with new devices and services, as well as cope with an exponential increase in data usage.



Digital transformation and 5G operator case studies

Here, we have focused on operator trials and collaborative efforts in the fields of automotive, media and entertainment, agriculture and farming, and smart cities.

Automotive

Connected cars and automated driving have caught the public's imagination in a way that less consumer-facing industries have so far found more difficult to do. This demand has also been boosted due to the cross-industry developments in this field. Connected cars and automated driving are one of the early success stories of collaboration between the mobile industry and a vertical sector.

The 5G Automotive Association (5GAA), established in 2016, is a global, cross-industry organization of companies from the automotive, technology, and telecommunications industries, working together to develop solutions for future mobility and transportation services.

Audi, BMW, and Daimler are among the founding members. They have since been joined by many other companies including a number of CSPs from different corners of the globe—AT&T, China Mobile, NTT DOCOMO, Deutsche Telekom, Orange, Telefonica, Verizon, and Vodafone. Many of the discussions and trials have focused on cellular “vehicle to everything” (C-V2X) technology including both LTE-V2X and 5G-V2X. 5G is regarded as absolutely essential to enable full connected and automated driving in the future, with reduced latency certainly a primary requirement in this field.

Meanwhile, most major operators are conducting their own trials of connected cars and automated driving. For example, Vodafone Germany has established the 5G Mobility Lab together with the Aldenhoven Testing Center to test all manner of IoT solutions from telematics to V2X. It is also testing vehicle-to-vehicle communication and geo-messaging solutions for cars along the A9 motorway in Germany, between Munich and Ingolstadt. They are using an advanced version of LTE as part of a testbed with other partners for future 5G services.

Media and entertainment

In 2017, AT&T unveiled a trial with DIRECTV to test the delivery of its DIRECTV NOW OTT service over a fixed wireless 5G signal in Austin, Texas (the U.S.). At the time, the operator said this was a first major step on its journey to deliver 5G speeds by late 2018. Latency is a huge challenge in this field and there are high expectations here that multi-access edge computing (MEC) will help resolve problems related to latency, buffering, and overall delays.

AT&T has since said it expects to be the first U.S. company to introduce mobile 5G services in a dozen markets by late 2018. However, the chief technology officer and president of global networks at Verizon said during CES 2018 in Las Vegas that Verizon will be the first U.S. carrier to launch 5G.

In Europe, Deutsche Telekom also showcased 5G use cases on its 5G pre-commercial network in Berlin. It included 5G virtual reality (VR) and augmented reality (AR), noting that AR and VR applications benefit from 5G's super high data rates and real-time responses. The CSP noted that a particular highlight was the live transmission of an ultra-high-definition video stream over 5G NR to a VR device.

Agriculture and farming

Vodafone said it is already able to provide drone connectivity using 4G network capability and is also working with partners on the use of drones as a service for future applications. These include automatic drones for precision farming or protecting critical infrastructure. The operator believes that controlling the drones over a 5G network would yield a number of important benefits and is championing a catalyst project of the TM Forum that is focusing on how to deliver drones as a service.



Smart cities and smart buildings

5G is regarded as an important network evolution to support smart services and smart cities in the future. In June 2017, Sacramento in California announced a tentative agreement with Verizon to create a public-private partnership designed to bring smart city infrastructure and services to people living and working in the city. The planned program outlined at the time included efforts to drive innovation and 5G connectivity with a “significant infrastructure investment” throughout the Sacramento community.

Since then, Verizon has said it will launch 5G wireless residential broadband services in three to five cities in 2018, with the first commercial launch planned to be in Sacramento in the second half of 2018.

Digital transformation: Looking outside 5G

Without digital transformation, 5G would not be possible because of the fundamental changes required in terms of network virtualization to support the different use cases outlined above. Of course, digital transformation also goes far beyond 5G, as it reaches into all aspects of an operator’s business and is already having an impact on services and operations today.

In the view of Yves Bellego, director of network strategy at Orange,³ digital transformation mainly addresses the customer relationship through customer relationship management (CRM) and customer experience management (CEM). Orange’s plan is to enhance the digital relationship with its customers through the development of an omnichannel relationship. It’s also looking toward a mobile application for customers to manage their services, with the ambition of growing the proportion of digital customer interactions drastically in 2018.

“Big Data is enabling us to improve CEM, and IT technologies such as DevOps are helping us to adapt our internal processes to the need for faster delivery of new functions. We have also applied digital transformation internally within Orange. For example, we have rolled out e-learning and have our own internal social network, named Piazza,” said Bellego.

Vodafone, meanwhile, has also been working on the development of an omnichannel experience for its customers to meet the needs of an increasingly digital-savvy audience. In the U.K., it has launched the “Message Us” messaging platform designed to enable customers to start a conversation with a Vodafone U.K. customer adviser and then pick up the same thread at a later time. The service is based on a software platform developed by New York-based LivePerson. Plans also included a closer integration of Message Us with Vodafone’s TOBi chatbot to enable the digital assistant to work alongside human advisers to deal with more complex queries.

Deutsche Telekom and AT&T are also examples of operators on both sides of the Atlantic that have long since recognized the need for fundamental change. Deutsche Telekom has introduced measures that affect the very way employees work—with hot desking now obligatory in all of its offices. The **Magenta** brand is utilized throughout Europe to support its fixed-mobile integration strategy, while the “uncarrier” approach has become famous in the U.S. for its different take on the role of the operator. Furthermore, **QIVICON**, Deutsche Telekom’s smart home platform, has more than 40 partner companies working on various products and services.

³ **Transforming towards digital business**
Mobile World Live, December 2017



AT&T has based its internal transformation on Enhanced Control, Orchestration, Management, and Policy (ECOMP). This cloud management platform has contributed to the Linux® Foundation open source Open Network Automation Platform (ONAP) initiative. It is a means of integrating into the system and rolling out new services from AT&T and third parties in a manner that is consistent, automated, and seamless—a process generally known as onboarding.

AT&T has also created six Foundry Innovation Centers to specialize in different digital areas. Ranging from IoT and the connected car to SDNs, these centers allow AT&T's innovators to work with outside experts in developing consumer and business solutions.

CSPs are not only supporting the digital transformation efforts of their own business customers but are also reaping the benefits of changes in their own structures. This helps them launch digital services and applications that will one day benefit from the improved latency and higher speeds of 5G networks. What's more, the CSPs can also operate on current networks.

In one example, NTT DOCOMO in Japan has focused on the “smart life” initiative to achieve sustainable growth in the face of severe competition from mobile network operators and mobile virtual network operators (MVNOs). The operator is providing consumer services including digital content services, health and education, and financial services.

Other services include VR and AR, which offer huge potential for the consumer, enterprise, and industrial segments. Early examples of success include the AR-based **Pokémon Go**, which was widely promoted by mobile operators and has been responsible for huge spikes in mobile data traffic. GSMA Intelligence (GSMAi) noted that Pokémon Go became the fastest mobile game in history to surpass \$1 billion in worldwide gross revenues, doing so after just over six months.

Orange commented that there are various services that it has been able to develop on 4G that can then be expanded further in terms of performance and scale with 5G, including IoT and public safety. Banking and financial services were also identified as a strategic area for diversification and the group saw a window of opportunity to enhance digital banking in Europe. The CSP noted that the market for direct/digital banking is still developing, particularly in France, due to the appetite for consuming services via mobile—which continues to rise.

“A new opportunity for Orange is the development of banking services. For some years now, we have offered payment and money transfer services in our African countries through Orange Money, which has since extended into services like international money transfer and bill payments for utilities (e.g., electricity). We also announced the launch of Orange Bank, first in France before we roll this out to Spain and Belgium in the coming years,” added Bellego.

In addition, zero-rated services have continued to evolve as a way in which CSPs can offer differentiated digital services to their customers by exempting certain streaming video, music, chat, or social networks from data allowances. Although some services have met with resistance from national regulators in Europe because of the concerns that they infringe the European Union net neutrality regulations it has not stopped operators from launching and marketing services. In fact, it would be difficult to find a developed market where zero-rating is not available.

Some high-profile zero-rating programs include **Binge On** from T-Mobile US, while Deutsche Telekom offers **Stream On** services in some of its European markets. Vodafone has placed a strong focus on **Vodafone Pass**—including Video Pass, Music Pass, Social Pass, Chat Pass, and Maps Pass now available in various configurations depending on the market.



Digital transformation: Survey results show appetite for 5G services

SDxCentral also carried out a survey in Q4 2017 to understand the state of 5G services. SDxCentral and HPE used this data to understand from CSPs the types of 5G services they are testing or already running in their networks.

As you would expect, most respondents said they are engaged with the **IoT**, which is an area that is also set to benefit massively from the improved network capabilities of 5G. Linked to the IoT are smart cities and smart buildings, with about half of respondents indicating deployments in this field.

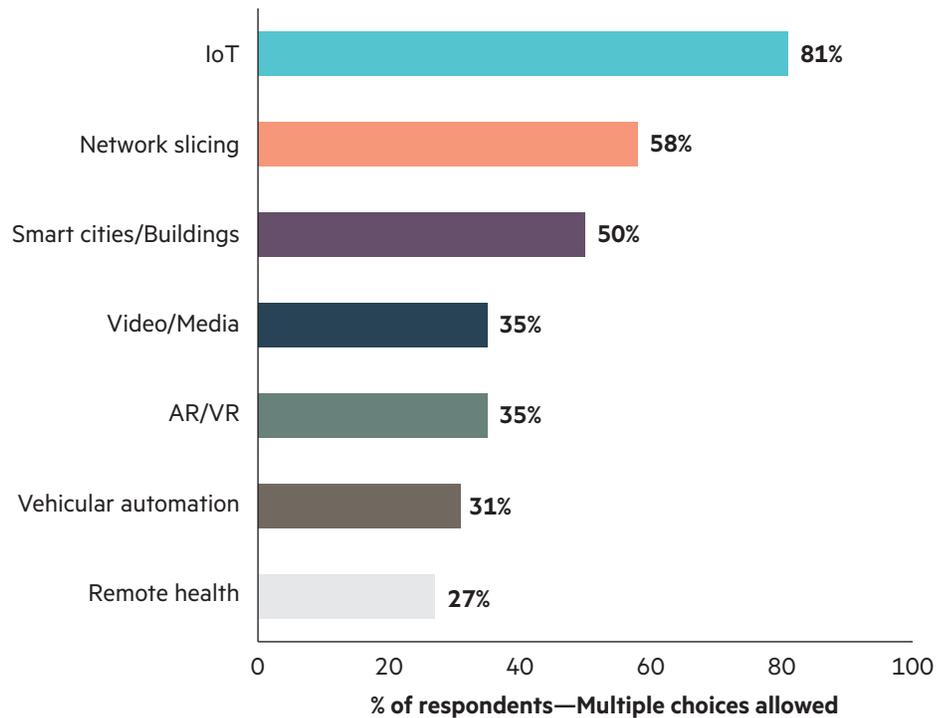


Figure 1. Use cases already deployed in respondent's networks (including POC and trials)

Over half of the survey respondents also cited network slicing, a practice that can potentially open new business models for carriers to sell or share virtualized parts of the network in a secure and isolated manner to different companies. Network slicing involves providing different types of network for different traffic, such as a network for sensor traffic (often a large number of streams of small amounts of data) as opposed to a network that transmits media or large Big Data sets.



More than a third of survey respondents voted for VR and AR—two services that would certainly benefit from **edge-computing technologies** to reduce latency issues, as well as video and media-related services, remote healthcare, and automated cars. Some new and less common use cases that emerged included hologram video and autonomous mining. In terms of the different vertical markets that offer the greatest potential for 5G, almost 75% of respondents cited transportation and logistics, with media and entertainment not far behind. Retail and healthcare garnered 46% and 54% of the votes respectively, while manufacturing received 50% of the votes.

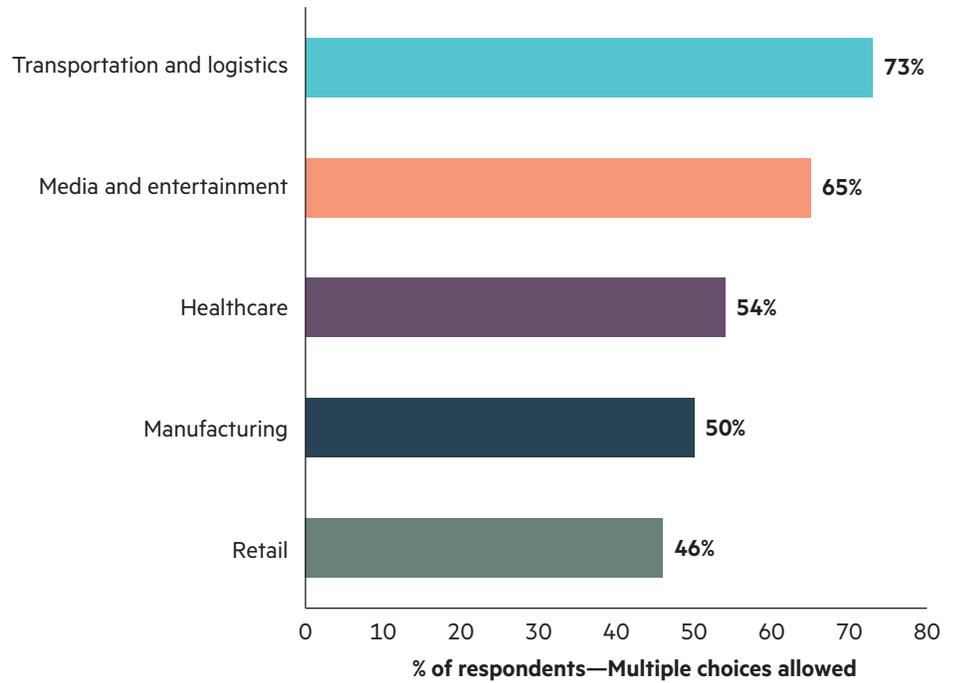


Figure 2. Enterprise vertical CSPs likely to target with 5G

The survey also sought views on potential inhibitors to 5G networks. Somewhat surprisingly in view of the recent 3GPP announcement on Non-Standalone 5G NR, delays in standards was regarded as still a big inhibitor by 20% of respondents. It was also interesting to see that a minority (12%) have concerns that there will be a lack of compelling business models for new applications—an interesting perspective in view of industry-wide efforts to frame use cases for 5G.



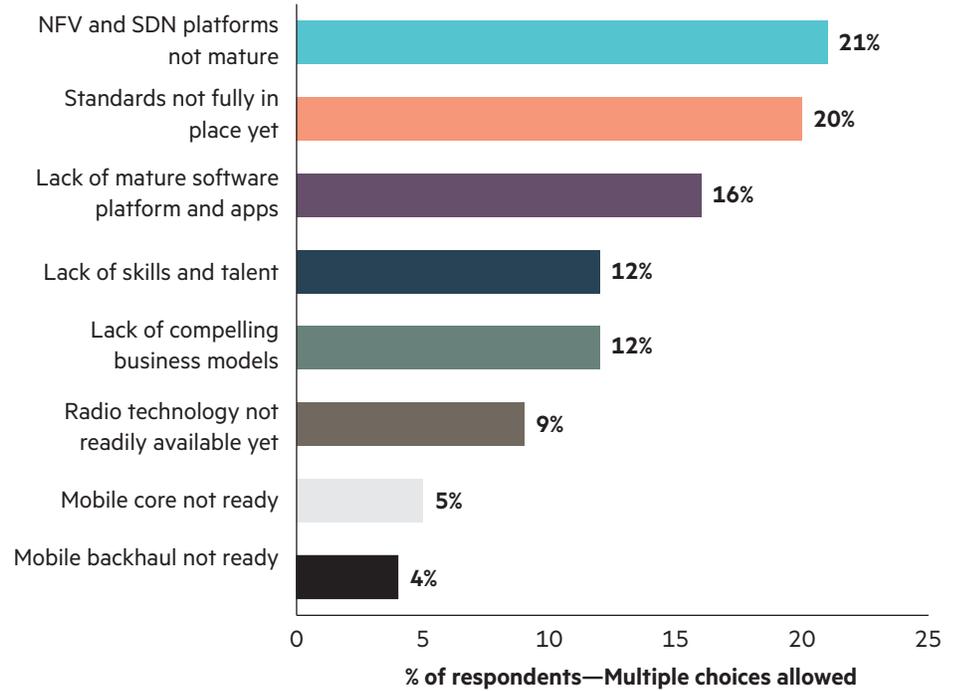


Figure 3. Biggest inhibitors to 5G rollout

Operators are clearly expecting to make money from 5G once the various technology hurdles have been resolved, with more than 60% saying they expect average revenue per user (ARPU) from consumers to increase. Meanwhile, close to 70% expect average revenue per enterprise (ARPE) to be higher.

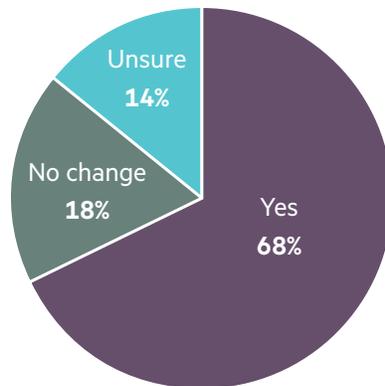


Figure 4. Do you expect consumer ARPU to increase with 5G Services?

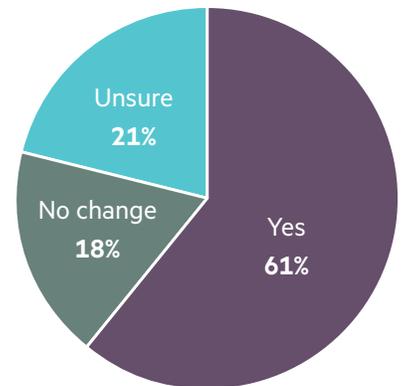


Figure 5. Do you expect ARPE to increase with 5G services?



Conclusion

Digital transformation forms the very basis for 5G service. As we have discussed, business, cultural, and system changes are required to lay the foundation to deploy, support, and monetize new 5G services. At the same time, digital transformation is already having an impact on **CSP operations and services**. Those CSPs that are able to digitize customer experience, simplify and harmonize business processes, and optimize operations will be best placed to gain a competitive advantage in today's complex and challenging business environment.

Indeed, CSPs are already accruing benefits today with new services and operational strategies that are not necessarily 5G related. Related to this is the platform economy—which comprises a distinctly new set of economic relations that depend on the internet, computation, and data. The ecosystem created by each platform is a source of value and sets the terms by which users can participate. For CSPs, the platform economy is where smartphones, software, and open APIs create and scale new digital marketplaces for a big range of services and products.

In an EY survey titled **Digital transformation for 2020 and beyond** (published in June 2017), CSPs were asked to name their top three strategic priorities through 2020. Three focus areas were cited by more than half of respondents—digital business models, customer experience, and cost control and business efficiencies. When asked what the most important enablers of innovation for their organization will be in the next three years, participants cited analytics-based insights and virtualized networks. They also said the IT would be the top driver of innovative capabilities followed by acquiring and developing talented people, along with partnerships with OTT players and other third parties.

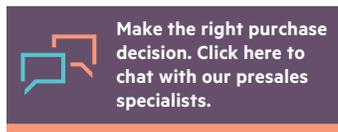
EY commented that as operators move into adjacent growth segments, business model adjustments are more critical than ever before if operators are to create winning customer experiences in both the legacy and new service domains. At the same time, digital business models are unlocking a new wave of efficiencies.

The July 2017 **CAPEX Report** from GSMAi also provides an indication of where operators are currently investing their money in order to support their digital transformation strategies at a network level. It forecasts that between 2017 and 2020, mobile operators will spend \$673 billion on CAPEX, compared to \$772 billion over the preceding four years.

GSMAi found that operators in developed markets are focusing their investments on network densification and upgrades within the LTE standard. "There is also an increased focus on investment in fiber networks, which can backhaul data and provide a competitive edge in the move to 5G, as well as offer operators the opportunity to provide converged products," the research company said.

In essence, as McKinsey points out, making smart use of digital technologies across the whole business "is an imperative for telecom operators that want not only to combat the declining growth, shrinking margins, and intensifying competition of recent years, but also to seize opportunities that could make them stronger and more profitable than before. Getting it right will involve a wholesale digital transformation that starts with full commitment and strong leadership from the top."

Learn more at
hpe.com/dsp/transform



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